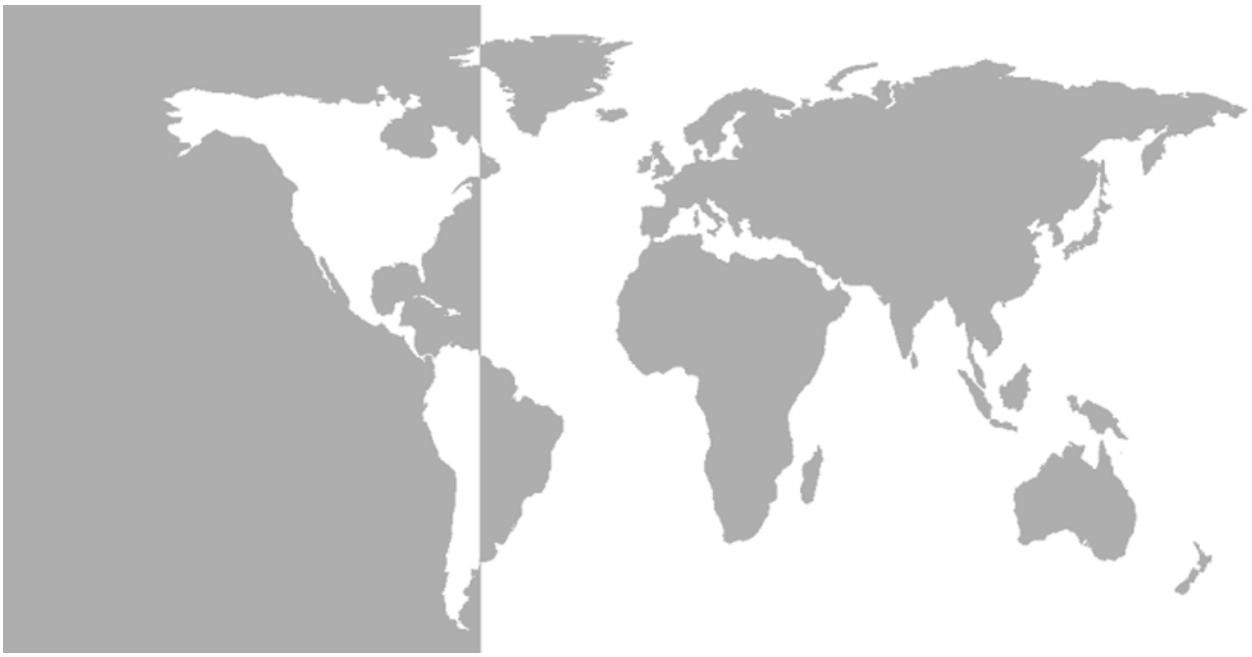
GE
Sensing



DigitalFlow™ GF868

Panametrics Ultrasonic Flowmeter for Flare Gas

Startup Guide (1 and 2-Channel)

GE
Sensing

DigitalFlow™ GF868

Panametrics Ultrasonic Flowmeter for Flare Gas

Startup Guide (1 and 2-Channel)

910-194UD
January 2007

DigitalFlow™ is a GE Panametrics product. GE Panametrics has joined other GE high-technology sensing businesses under a new name—GE Sensing.

Warranty

Each instrument manufactured by GE Sensing, Inc. is warranted to be free from defects in material and workmanship. Liability under this warranty is limited to restoring the instrument to normal operation or replacing the instrument, at the sole discretion of GE. Fuses and batteries are specifically excluded from any liability. This warranty is effective from the date of delivery to the original purchaser. If GE determines that the equipment was defective, the warranty period is:

- one year for general electronic failures of the instrument
- one year for mechanical failures of the sensor

If GE determines that the equipment was damaged by misuse, improper installation, the use of unauthorized replacement parts, or operating conditions outside the guidelines specified by GE, the repairs are not covered under this warranty.

The warranties set forth herein are exclusive and are in lieu of all other warranties whether statutory, express or implied (including warranties of merchantability and fitness for a particular purpose, and warranties arising from course of dealing or usage or trade).

Return Policy

If a GE Sensing, Inc. instrument malfunctions within the warranty period, the following procedure must be completed:

1. Notify GE, giving full details of the problem, and provide the model number and serial number of the instrument. If the nature of the problem indicates the need for factory service, GE will issue a RETURN AUTHORIZATION number (RA), and shipping instructions for the return of the instrument to a service center will be provided.
2. If GE instructs you to send your instrument to a service center, it must be shipped prepaid to the authorized repair station indicated in the shipping instructions.
3. Upon receipt, GE will evaluate the instrument to determine the cause of the malfunction.

Then, one of the following courses of action will then be taken:

- If the damage is covered under the terms of the warranty, the instrument will be repaired at no cost to the owner and returned.
- If GE determines that the damage is not covered under the terms of the warranty, or if the warranty has expired, an estimate for the cost of the repairs at standard rates will be provided. Upon receipt of the owner's approval to proceed, the instrument will be repaired and returned.

Table of Contents

Chapter 1: Installation

Introduction . . . 1-1
Unpacking . . . 1-1
Site Considerations . . . 1-2
- Electronics Console Location . . . 1-2
- Flowcell Location . . . 1-2
- Transducer Locations . . . 1-2
- Cable Lengths . . . 1-2
- Temperature and Pressure Transmitters . . . 1-3
- Transducer Cables . . . 1-3

Installing a Flowcell . . . 1-3
Installing Temperature and Pressure Transmitters . . . 1-5
Mounting the GF868 Enclosure . . . 1-6
Making Electrical Connections . . . 1-6
- Wiring the Line Power . . . 1-7
- Wiring the Transducers . . . 1-8
- Wiring the 0/4-20 mA Analog Outputs . . . 1-9
- Wiring the Serial Port . . . 1-9
- Wiring an Alarms Option Card . . . 1-13
- Wiring a 0/4-20 mA Analog Inputs Option Card . . . 1-14
- Wiring the Totalizer/ Frequency Outputs . . . 1-15
- Wiring the RTD Inputs . . . 1-15

Chapter 2: Initial Setup

Introduction . . . 2-1
Navigating Through the User Program . . . 2-1
Accessing the User Program . . . 2-2
- 1-Channel Meter . . . 2-2
- 2-Channel Meter . . . 2-2

Activating a Channel . . . 2-3
- 1-Channel Meter . . . 2-3
- 2-Channel Meter . . . 2-3
- 1 and 2-Channel Meters . . . 2-3

Entering System Data for a Channel . . . 2-4
- A 1-Channel Meter . . . 2-4
- A 2-Channel Meter . . . 2-5
- 1 and 2-Channel Meters . . . 2-5

Entering Pipe Data . . . 2-7
- Transducer Number . . . 2-7
- Pipe OD . . . 2-7
- Pipe Wall . . . 2-8
- Path Length . . . 2-8
- Axial Length . . . 2-8
- Reynolds Correction . . . 2-8
- Further Options . . . 2-9

Table of Contents (cont.)

Chapter 3: Operation

Introduction 3-1
Powering Up 3-2
Using the Display. 3-3
Taking Measurements 3-5
Foundation Fieldbus Communications. 3-6

Chapter 4: Specifications

General Specifications. 4-1
Flow Accuracy (% of Reading) 4-1
Molecular Weight and Mass Flow Accuracy (% of Reading) 4-1
Electrical Specifications 4-2
Operational Specifications. 4-4
Transducer/Flowcell Specifications 4-5
Transducer Type 4-5
Mounting and Installation. 4-5
Flowcell Specifications 4-5
Spoolpiece 4-5
Hot/Cold Tap 4-5
Preamplifier with Explosion-proof Housing. 4-5

Appendix A: CE Mark Compliance

Introduction A-1
Wiring A-1

Appendix B: Data Records

Option Cards Installed B-1
Initial Setup Data. B-2

Appendix C: Optional Enclosures

Introduction C-1
Rack Mount Enclosure C-1
Rack Mount Wiring C-1
Rack Mount Front Panel C-2

Appendix D: Measuring P and L Dimensions

Introduction D-1
Measuring P and L Distances D-1

Chapter 1

Installation

Introduction 1-1

Unpacking 1-1

Site Considerations 1-2

Installing a Flowcell 1-3

Installing Temperature and Pressure Transmitters 1-5

Mounting the GF868 Enclosure 1-6

Making Electrical Connections 1-6

Introduction

To ensure safe and reliable operation of the Model GF868 flowmeter for flare gas, the system must be installed in accordance with the guidelines established by GE Sensing's engineers. This section explains how to install the Model GF868 electronics console and make wiring connections. It covers:

- Unpacking - How to unpack the GF868 system.
- Selecting a suitable site for the electronics console and the flowcell/transducers.
- Installing a flowcell
- Installing temperature and pressure transmitters
- Installing the electronics console
- Wiring the electronics console

!WARNING!
THE MODEL GF868 FLOWMETER MEASURES THE FLOW OF MANY GASES, SOME OF THEM POTENTIALLY HAZARDOUS. WE CANNOT OVEREMPHASIZE THE IMPORTANCE OF SAFETY. BE SURE TO FOLLOW ALL APPLICABLE SAFETY CODES AND REGULATIONS FOR INSTALLING ELECTRICAL EQUIPMENT IN YOUR AREA AND WHEN WORKING WITH PARTICULARLY HAZARDOUS GASES OR FLOW CONDITIONS. CONSULT YOUR COMPANY SAFETY PERSONNEL OR LOCAL SAFETY AUTHORITIES IF YOU ARE UNSURE ABOUT THE SAFETY OF ANY PROCEDURE OR PRACTICE.

ATTENTION EUROPEAN CUSTOMERS!
IN ORDER TO MEET CE MARK REQUIREMENTS, YOU MUST MAKE ALL WIRING CONNECTIONS AS DESCRIBEDIN APPENDIX A, CE MARK COMPLIANCE.

Unpacking

Remove the electronics console, transducers, and cables from the shipping containers. Check all packing material before discarding it to account for all parts and documentation listed on the packing slip. If anything is missing or damaged, contact the factory immediately for assistance.

Site Considerations

Since the relative physical locations of the flowcell(s) and the GF868 electronics are important, use the guidelines given in this section when planning your GF868 system installation.

Electronics Console Location

Normally, the GF868 electronics enclosure is a Type-4X weather-resistant, dust-tight, indoor/outdoor type. (Other enclosure options are described in Appendix C.) Typically, the electronics console is mounted in a meter shed. If it is not, select a location that allows you access to your meter for programming, testing, and servicing.

Note: *For compliance with the European Union's Low Voltage Directive (IEC 1010), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 6 ft (1.8 m) of the GF868.*

Flowcell Location

The pipeline flowcell consists of the flowmeter transducers and any pressure and temperature transducers that may be used as part of the flowmeter system. Ideally, the section of pipe chosen as the flowcell should be a pipe section with easy access; for example, a long stretch of pipe that is above ground. However, if the flowcell must be on an underground pipe, dig a pit around the pipe to facilitate the transducer mechanisms.

Transducer Locations

For a given gas and pipe, the Model GF868's accuracy depends primarily on the location and alignment of the transducers on the pipe. In addition to accessibility, when planning for transducer location, consider the following guidelines:

- Locate the transducers so that there are at least 20 pipe diameters of straight, undisturbed flow upstream and 10 pipe diameters of straight, undisturbed flow downstream from the measurement point. To ensure undisturbed flow, avoid: sources of turbulence in the fluid such as valves, flanges, expansions and elbows; swirl; and dips or low spots in which condensed liquid may collect.
- Because condensate or sediment that collects at the bottom of the pipe may cause increased attenuation of the ultrasonic signal, locate the transducers on the side of a horizontal pipe, where possible. If limited pipe access necessitates top-mounted transducers and the sound beam path includes a reflection, shift the transducers to at least 10° off top center. This will minimize the influence of any sediment on the reflected ultrasonic signals.

Cable Lengths

Locate the transducers as close as possible to the electronics console. GE Sensing can supply transducer cables up to 500 ft (153 m) in length. For longer distances, consult the factory.

Temperature and Pressure Transmitters

When installing temperature and pressure transmitters, locate them downstream of the flowmeter transducers. These transmitters should be positioned no closer to the flowmeter transducers than 2 pipe diameters and no further away from the transducers than 20 pipe diameters.

Transducer Cables

When installing the transducer cables, always observe established standard practices for the installation of electrical cables. Specifically, do not route transducer cables alongside high amperage AC power cables, or any other cables that could cause electrical interference. Also, protect the cables and connections from the weather and corrosive atmospheres.

Note: *If you are using your own cabling to connect the transducers to the electronics console, the cabling must have electrical characteristics identical to the cable supplied by GE Sensing. Cable must be type RG 62 A/U coaxial cable (93 Ω) and each cable must be the same length (within ± 4 in.).*

Installing a Flowcell

A flowcell is the section of pipe where the transducers are mounted. It can be created either by mounting the transducers on the existing pipeline or on a spoolpiece.A spoolpiece is a separately manufactured pipe section, matched to the existing pipe, which contains ports for mounting the transducers. This approach allows the transducers to be aligned and calibrated before mounting the spoolpiece into the pipeline.

Figure 1-1 on the next page shows a block diagram of a typical Model GF868 system, including optional pressure and temperature transmitters. For detailed instructions on installing the transducers and/or spoolpiece, refer to the supplied drawings and the GE Sensing *Transducer Installation Guide.*

Caution!

The manual insertion mechanism systems are for low pressure applications (80 psig/5.5 bar or less). Use the appropriate safety precautions when inserting or withdrawing the insertion mechanism.

Installing a Flowcell (cont.)

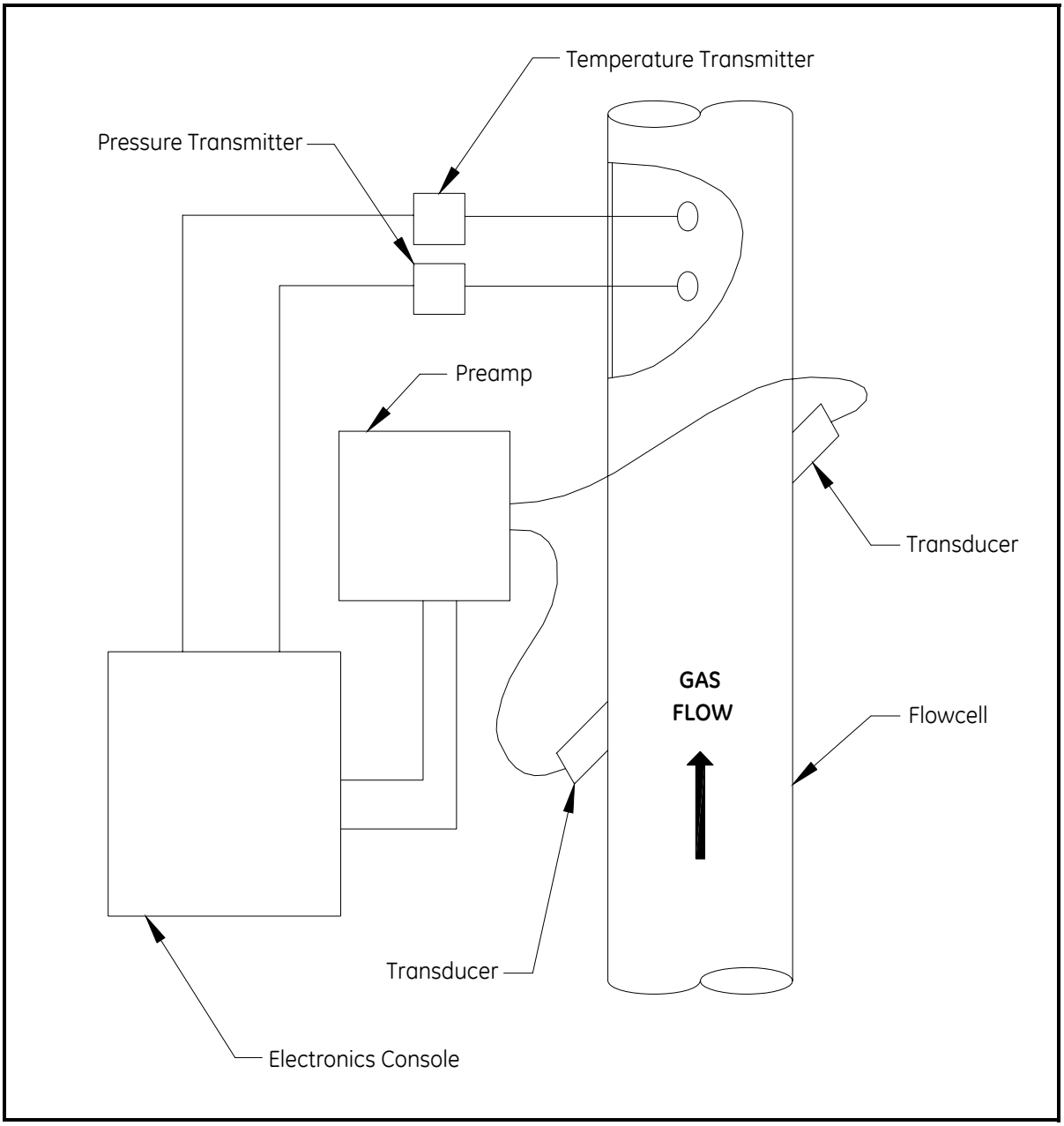


Figure 1-1: Model GF868 Flowmeter System

Installing Temperature and Pressure Transmitters

Temperature and pressure transmitters may be installed as part of the flowcell, near the ultrasonic transducer ports. (Be sure to observe the siting requirements mentioned earlier.) These transmitters must use a 0/4 to 20-mA signal to transmit temperature and pressure values to the GF868 console. The console, in turn, provides 24-VDC power to the transmitter. You can use any desired transmitters or sensors; however, they must have an accuracy of 0.5% of the reading or better.

Note: *Resistive Thermal Devices (RTDs) are typically used to measure temperature.*

Typically, a 1/2" or 3/4" NPT female threaded port is used to mount the transmitters on the flowcell. If the pipeline is insulated, you may need to extend the coupling to provide convenient access. Of course, you may also use other types of mounting ports, including flanged ports, for the transmitters.

The 4 to 20-mA transmitters typically mount directly into the ports as shown in Figure 1-2 below. The temperature sensor should protrude 1/4 to 1/2 way into the pipe.

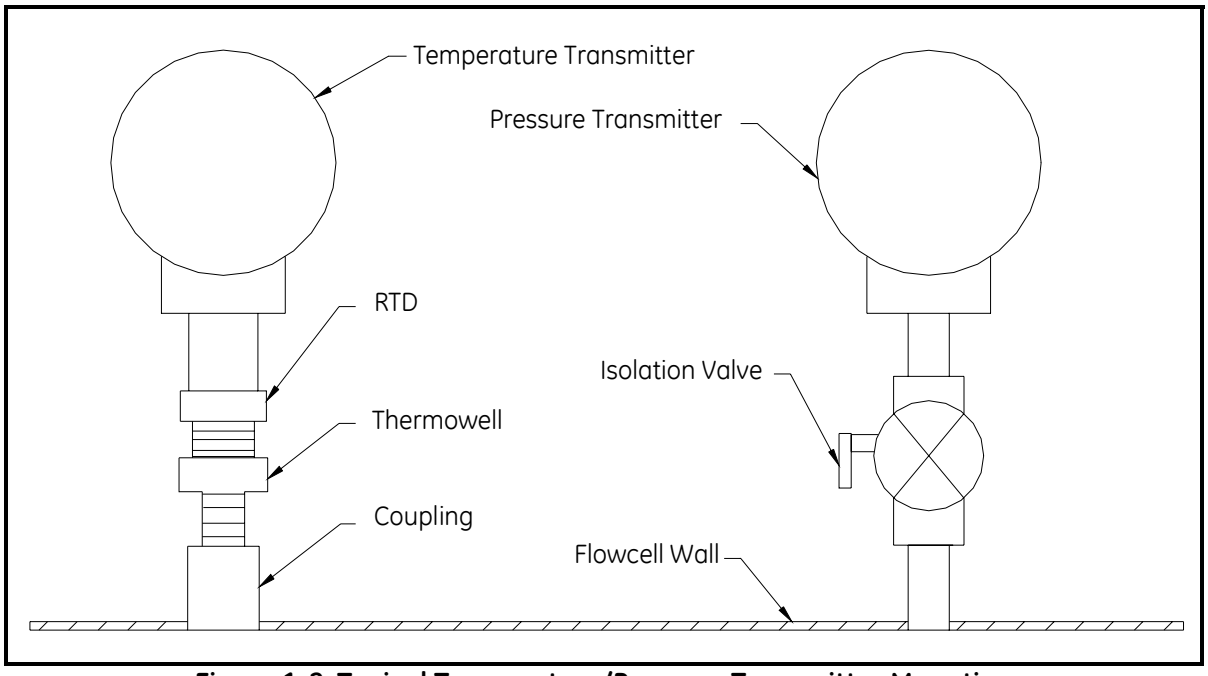


Figure 1-2: Typical Temperature/Pressure Transmitter Mounting

Mounting the GF868 Enclosure

The standard GF868 is housed in a Type-4X weather-resistant enclosure. Other enclosure options are available, and are discussed in Appendix C. Refer to Figure 1-7 on page 1-16 for the standard enclosure mounting dimensions. For meters housed in one of the optional enclosures, a dimensional drawing will be shipped with the unit.

Making Electrical Connections

This section contains instructions for making all the necessary electrical connections to the Model GF868 flowmeter. Refer to Figure 1-8 on page 1-17 for a complete wiring diagram.

RACK MOUNT CUSTOMERS:
PLEASE REFER TO APPENDIX C FOR A WIRING DIAGRAM AND INSTALLATION INFORMATION FOR YOUR UNIT.

Except for the power connector, all terminal blocks are stored in their terminal blocks during shipment and are removable for more convenient wiring. Feed all cables through the conduit holes on the bottom of the enclosure, attach the wires to the appropriate connectors, and plug the connectors back into their terminal blocks.

!WARNING!
To ensure the safe operation of the Model GF868, you must install and operate it as described in this manual. In addition, be sure to follow all applicable safety codes and regulations for installing electrical equipment in your area.

ATTENTION EUROPEAN CUSTOMERS!
IN ORDER TO MEET CE MARK REQUIREMENTS, YOU MUST INSTALL CABLES AS DESCRIBED IN APPENDIX A.

Note: *If your unit complies with the European Union's Low Voltage Directive (IEC 1010), it has a transparent plastic cover over the electrical connections. This cover must remain in place except while you are wiring your unit. Reinstall the shroud after the wiring has been completed.*

Once the GF868 is completely wired, proceed to Chapter 2, *Initial Setup*, to configure the unit for operation.

Wiring the Line Power

The Model GF868 may be ordered with power inputs of 100-120 VAC, 220-240 VAC, or 12-28 VDC. The label on the shroud inside the electronics enclosure, just above the TB1 line power terminal block, lists the line voltage setting and fuse rating for your unit. (The fuse rating also appears in Chapter 4, *Specifications.*) Be sure to connect the meter only to the correct line voltage. The allowable line voltages and fuse ratings are shown in Table 1-1 on page 1-9.

Note: *For compliance with the European Union's Low Voltage Directive (IEC 1010), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 6 ft (1.8 m) of the GF868.*

Refer to Figure 1-8 on page 1-17 to locate terminal block TB1. Follow these steps to connect the line power:

1. Prepare the line power leads by trimming the line and neutral (or positive and negative) leads to a length 0.5 in. (1 cm) shorter than the ground lead. This ensures that the ground is the last lead to detach if the power cable is forcibly disconnected from the meter.
2. If the unit is so equipped, remove the plastic shroud that covers the terminal blocks. Be sure to reinstall the shroud after all of the wiring has been completed.
3. Strip 1/4 in.of insulation from the end of each of the three line power leads.
4. Connect line power to terminal block TB1 as shown in Figure 1-8 on page 1-17.

!WARNING!
IMPROPER CONNECTION OF LINE POWER MAY DAMAGE YOUR UNIT. IT MAY ALSO RESULT IN HAZARDOUS VOLTAGESAT THE FLOWCELL AND ASSOCIATED PIPING, AND AT THE ELECTRONICS CONSOLE ENCLOSURE.

Wiring the Transducers

Wiring the GF868 ultrasonic flare gas flowmeter system requires interconnection of the following components:

- a pair of transducers mounted in the flowcell
- a preamplifier for each channel
- an optional lightning protector
- the GF868 console.

Use a coaxial cable to make all connections between the console and the transducers. Connect the transducers to terminal block CH1 as shown in Figures 1-7 and 1-8 on pages 1-16 and 1-17 respectively.

!WARNING!
Before connecting the transducers, discharge any static buildup in a safe area, by shorting the center conductor of the transducer cables to the metal shield of the cable connector.

Wiring the 0/4-20 mA Analog Outputs

The standard GF868 comes with two isolated 0/4-20 mA analog outputs (A and B). Use standard twisted-pair wiring to make connections to these outputs. The current loop impedance must not exceed 550 ohms.

Refer to Figure 1-8 on page 1-17 and connect the wires to the terminal block I/O as shown.

Wiring the Serial Port

The Model GF868 is equipped with a built-in serial communications port. The standard port is an RS232 interface, but an optional RS485 interface is available upon request. Proceed to the appropriate sub-section for wiring instructions. For more information on serial communications, refer to the *EIA-RS Serial Communications* Manual (916-054).

Wiring the RS232 Interface

The RS232 communications port provides a serial interface in order to connect the GF868 to a printer, an ANSI terminal or a personal computer.

The RS232 serial interface is wired as Data Terminal Equipment (DTE), and the signals available at the GF868 RS232 terminal block are shown in Table 1-1 below. Refer to Figure 1-8 on page 1-17 to locate terminal block RS232 and complete the following steps to wire the terminal:

1. Use the information in Table 1-1 below to construct a suitable cable for connecting the GF868 to the external device. (If desired, an appropriate cable may be purchased from GE Sensing.)

Table 1-1: RS232 Connection to DCE or DTE Device

RS232 Pin #	Signal Description	DCE DB25 Pin #	DTE DB25 Pin #	DTE DB9 Pin #
1	RTN (Return)	7	7	5
2	TX (Transmit)	2	3	3
3	RX (Receive)	3	2	2
4	DTR (Data Terminal Ready)	20	20	4
5	CTS (Clear to Send)	5	4	8

2. Wire the flying leads end of the cable to terminal block RS232 and connect the other end of the cable to the printer, ANSI terminal or personal computer.

After the wiring has been completed, consult the User's Manual for the external device to configure it for use with the GF868.

Wiring the RS485 Interface

Use the optional RS485 serial port to network multiple GF868 flowmeters to a single computer terminal. Upon request, the standard RS232 port on the GF868 may be configured as a two-wire, half-duplex RS485 interface, through a device such as the INMAC Model 800052 RS232-RS422/RS485 converter.

To wire the RS485 serial port, refer to Figure 1-8 on page 1-17 and complete the following steps:

1. Disconnect the main power to the unit and remove the cover.

2. Install the required cable clamp in the chosen conduit hole on the side of the electronics enclosure.

3. Feed one end of the cable through the conduit hole, wire it to terminal block J1 and secure the cable clamp. Connect the other end of the cable to the converter, as shown in Figure 1-3 below.

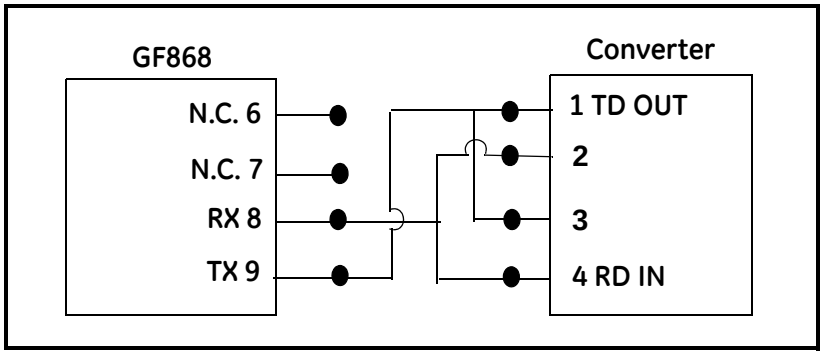


Figure 1-3: Typical RS485 Connections

!ATTENTION EUROPEAN CUSTOMERS!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, *CE Mark Compliance*.

4. If wiring of the unit has been completed, reinstall the plastic shroud, close the cover on the enclosure and tighten the latches.

5. Connect the converter to the control system, as described in its User's Manual.

Wiring the Ethernet Interface

A modified GF868 can use the Ethernet interface to communicate to an internal network. An optional Ethernet card with a unique MAC (IP) address (installed only in slots 5 or 6) includes an RJ45 connector. To connect the Ethernet-enabled GF868 to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through the bottom of the GF868, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions. An external connection is required between the Ethernet option card and the GF868's RS232 connector, as shown in Table 1-2 below.

Note: *The MAC address for a specific GF868 is included with customer documentation. For more information on setting up the MAC address, refer to Chapter 6 of the* Programming Manual.

Table 1-2: RS232 to Ethernet Interconnections

GF868 Type	Terminal Block	Terminal Block
Wall Mount	**RS232 on Main Board**	**TB1 on Ethernet Card**
	TX	Pin 1
	RX	Pin 2
	RTN	Pin 3
Rack Mount	**RS232 on Main Board**	**TB2 on Ethernet Card**
	TX	Pin 1
	RX	Pin 2
	RTN	Pin 3

Wiring the MODBUS/TCP Interface

Customers can also use a modified GF868 that provides a MODBUS/TCP interface to communicate to an internal network. An optional MODBUS/TCP card with a unique MAC (IP) address (installed only in slots 5 or 6) includes an RJ45 connector. To connect the MODBUS/TCP-enabled GF868 to the network, insert the jack of an RJ45 cable into the RJ45 connector, route the cable through the bottom of the GF868, and wire the other end of the cable to the Ethernet network according to the manufacturer's instructions.

Note: *The MAC address for a specific GF868 is included with customer documentation. For more information on setting up the MAC address, refer to Chapter 6 of the* Programming Manual.

Wiring the Foundation Fieldbus Network

Fieldbus network connections are made at J8/J9, pins 1 and 2 (see Figure 1-4 below). Optionally, a shield can be connected to J8/J9 pin 3, depending on the network wiring. Connector J8 or J9 will be installed depending on the option ordered by the customer.

No connections are made to J8/J9, pins 7 and 9, under normal operation. If it is desired to reset the network board to factory defaults:

1. Connect a jumper between J8/J9 pin 7 and pin 9.
2. Power cycle the instrument.
3. Ten seconds after the power has been restored to the unit, remove the jumper to return the network board to normal operation.

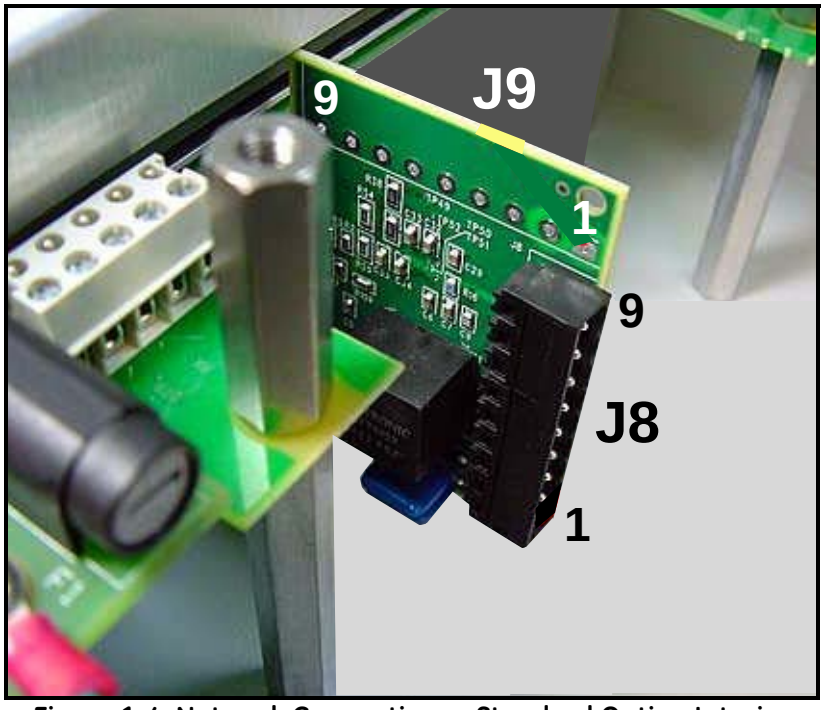


Figure 1-4: Network Connections - Standard Option Interior

Wiring an Alarms Option Card

The GF868 can accommodate 1 to 6 alarm option card(s). Each alarm option card provides three Form C relays (A, B and C). The alarm relays on the option card are available in two types:

- general-purpose
- hermetically-sealed for Class I, Division 2 hazardous areas.

Chapter 4, *Specifications,* lists the maximum electrical ratings for the relays. Each alarm relay can be wired as *Normally Open* (NO) or *Normally Closed* (NC).

In setting up an alarm relay, it may be wired for either *conventional* or *fail-safe* operation. In fail-safe mode, the alarm relay is constantly energized, except when it is triggered or a power failure or other interruption occurs. See Figure 1-4 below for the operation of a NO alarm relay in both conventional and fail-safe mode.

Connect the two alarm wires required for each relay in accordance with the pin number assignments shown in Figure 1-8 on page 1-17.

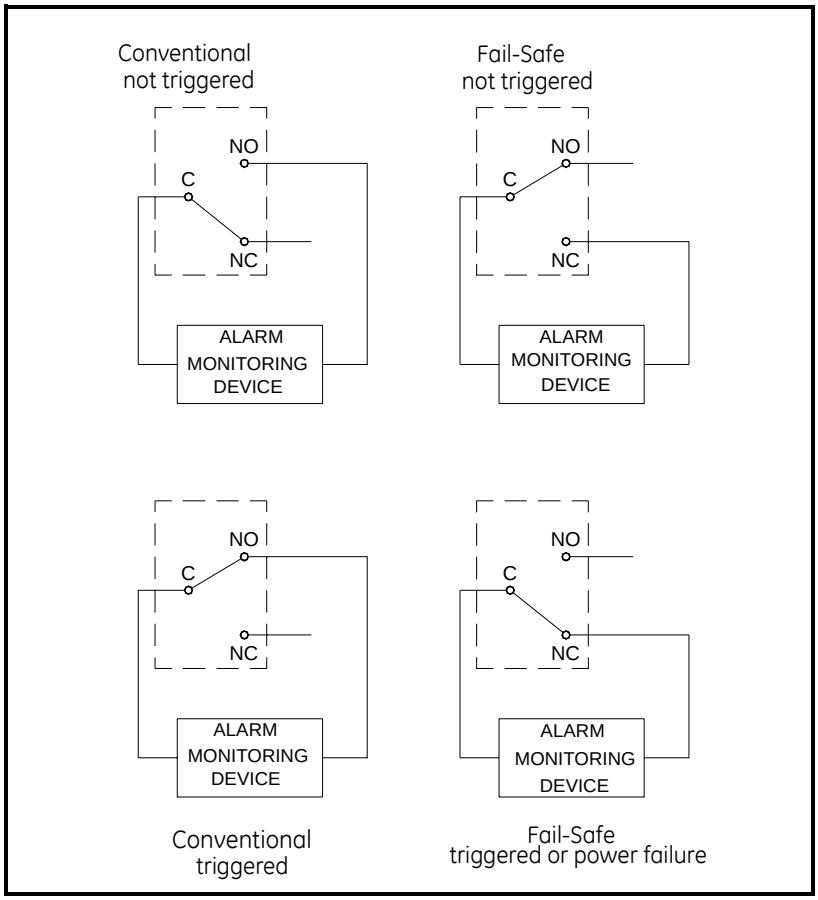


Figure 1-5: Conventional and Fail-Safe Operation

Wiring a 0/4-20 mA Analog Inputs Option Card

To calculate standard volumetric flow and mass flow of Flare Gas, the GF868 must have *temperature* and *pressure* data from the measurement site. Transmitters installed in the flowcell send this information to the analog input card. This card provides two isolated 4-20 mA inputs (A and B) with 24 VDC supply for loop-powered transmitters. You can assign the temperature and pressure inputs to A and B as desired.

Note: *To enter programming data during meter operation, you should know which input is assigned to which process parameter. Enter the connections in Appendix B,* Data Records.

The analog inputs, which have an impedance of 118 ohms, should be connected with standard twisted-pair wiring.Temperature and pressure inputs require two or four wires, depending on whether the GF868 will provide power to the transmitter. If desired, INLO and RTN can use the same wire.

Wire the analog input terminal block in accordance with the pin number assignments shown in Figure 1-8 on page 1-17.

The analog inputs on the option card(s) can be calibrated with the Model GF868's built-in analog outputs. However, be certain that the analog outputs have been calibrated first. See Chapter 1, *Calibration,* in the *Service Manual* for the appropriate procedures.

Wiring the Totalizer/ Frequency Outputs

The GF868 can accommodate 1 to 6 totalizer/frequency outputs option cards. Each totalizer/frequency outputs option card provides four outputs (A, B, C, and D) that can be used as either totalizer or frequency outputs.

Each totalizer/frequency output requires two wires. Wire this terminal block in accordance with the pin number assignments shown in Figure 1-8 on page 1-17. Figure 1-5 below shows sample wiring diagrams for the totalizer/frequency outputs.

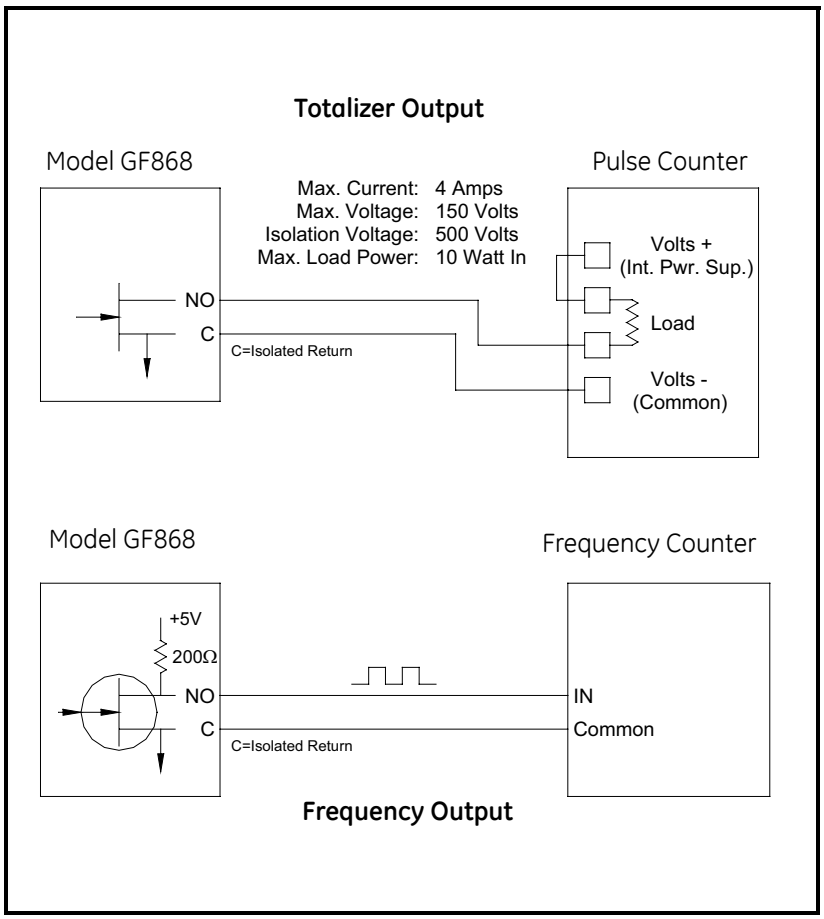


Figure 1-6: Totalizer/Frequency Output Wiring

Wiring the RTD Inputs

The GF868 can accommodate 1 to 6 RTD (Resistance Temperature Device) inputs card(s). Each RTD inputs card provides two direct RTD inputs (A and B).

Each RTD input requires three wires. Feed the wires through one of the conduit holes on the bottom center of the enclosure. Connect the wires to the 8-pin RTD inputs option card terminal block as shown in Figure 1-8 on page 1-17.

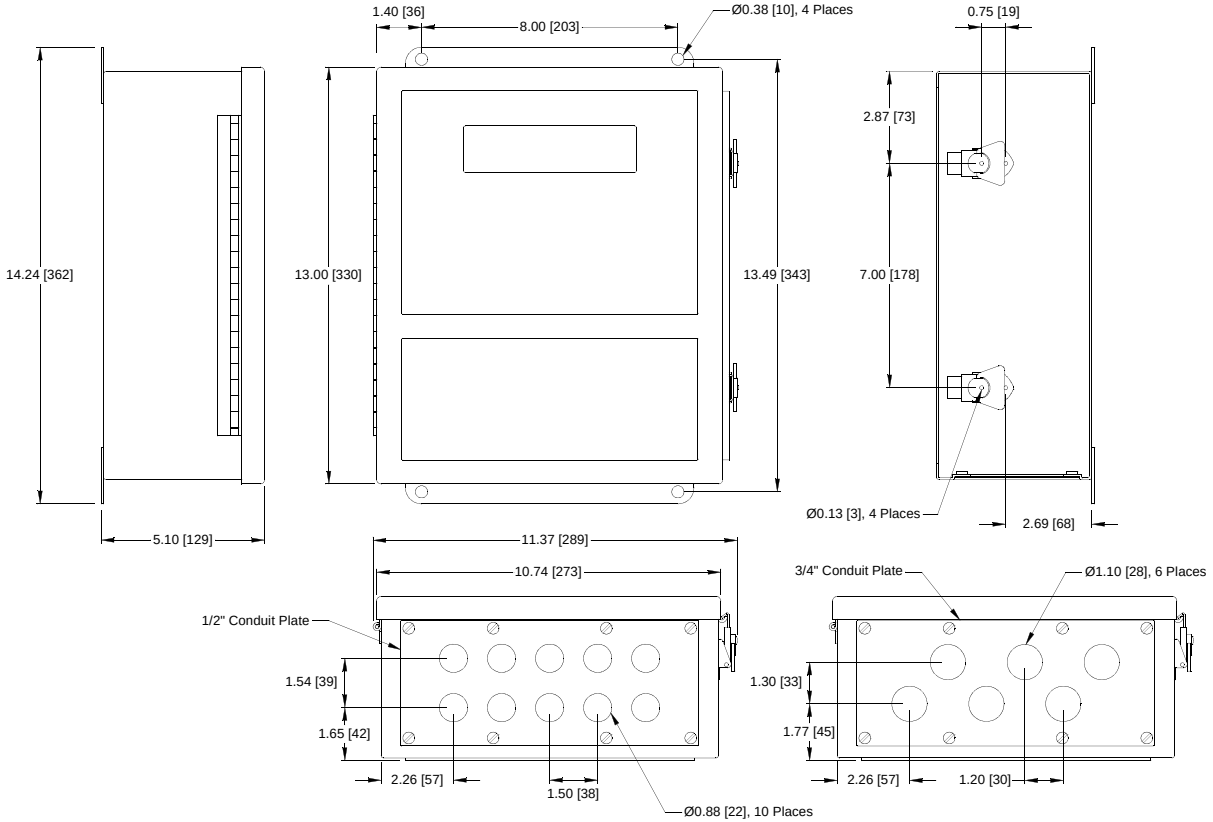
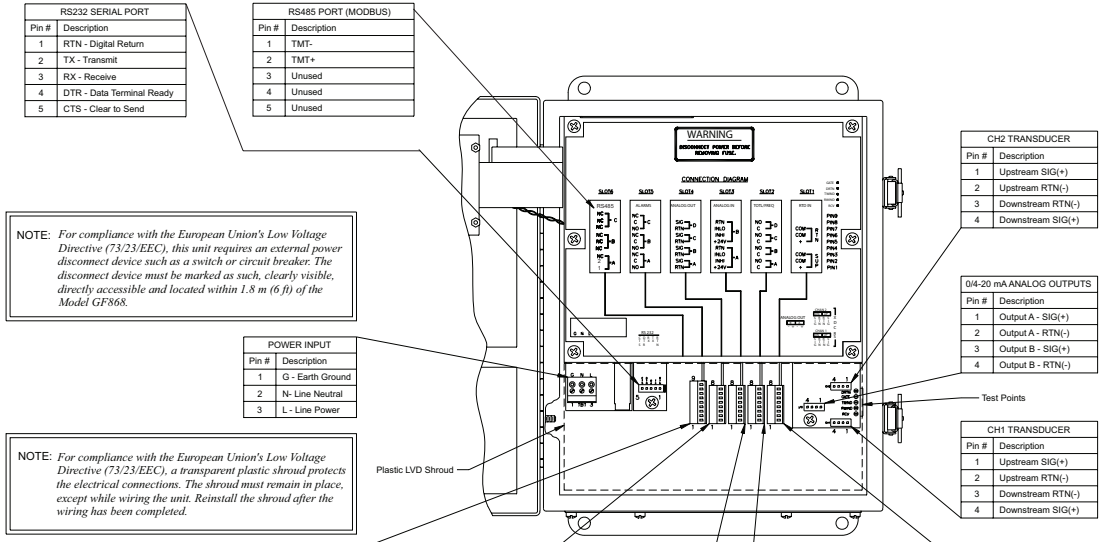


Figure 1-7: Model GF868 Type 4X Enclosure (Dwg. #425-208)



RS232 SERIAL PORT	
Pin #	Description
1	RTN - Digital Return
2	TX - Transmit
3	RX - Receive
4	DTR - Data Terminal Ready
5	CTS - Clear to Send

RS485 PORT (MODBUS)	
Pin #	Description
1	TMT-
2	TMT+
3	Unused
4	Unused
5	Unused

NOTE: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible and located within 1.8 m (6 ft) of the Model GF868.*

POWER INPUT	
Pin #	Description
1	G - Earth Ground
2	N- Line Neutral
3	L - Line Power

NOTE: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), a transparent plastic shroud protects the electrical connections. The shroud must remain in place, except while wiring the unit. Reinstall the shroud after the wiring has been completed.*

CH2 TRANSDUCER	
Pin #	Description
1	Upstream SIG(+)
2	Upstream RTN(-)
3	Downstream RTN(-)
4	Downstream SIG(+)

0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - SIG(+)
2	Output A - RTN(-)
3	Output B - SIG(+)
4	Output B - RTN(-)

CH1 TRANSDUCER	
Pin #	Description
1	Upstream SIG(+)
2	Upstream RTN(-)
3	Downstream RTN(-)
4	Downstream SIG(+)

ALARM RELAYS	
Pin #	Description
1	Relay A - Normally Open (NO)
2	Relay A - Common (C)
3	Relay A - Normally Closed (NC)
4	Relay B - Normally Open (NO)
5	Relay B - Common (C)
6	Relay B - Normally Closed (NC)
7	Relay C - Normally Open (NO)
8	Relay C - Common (C)
9	Relay C - Normally Closed (NC)

0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - RTN(-)
2	Output A - SIG(+)
3	Output B - RTN(-)
4	Output B - SIG(+)
5	Output C - RTN(-)
6	Output C - SIG(+)
7	Output D - RTN(-)
8	Output D - SIG(+)

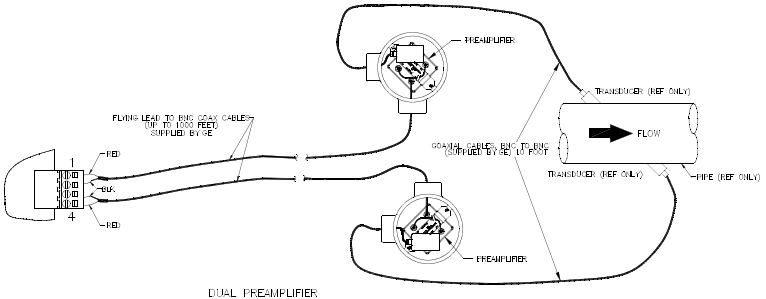
0/4-20 mA ANALOG INPUTS	
Pin #	Description
1	Input A - +24V
2	Input A - INHI
3	Input A - INLO
4	Input A - RTN
5	Input B - +24V
6	Input B - INHI
7	Input B - INLO
8	Input B - RTN

TOTALIZER/FREQUENCY OUTPUTS	
Pin #	Description
1	Output A - Common (C)
2	Output A - Normally Open (NO)
3	Output B - Common (C)
4	Output B - Normally Open (NO)
5	Output C - Common (C)
6	Output C - Normally Open (NO)
7	Output D - Common (C)
8	Output D - Normally Open (NO)

RTD INPUTS	
Pin #	Description
1	Input A - SIG(+)
2	Input A - Common (C)
3	Input A - Common (C)
4	Unused
5	Input B - SIG(+)
6	Input B - Common (C)
7	Input B - Common (C)
8	Unused

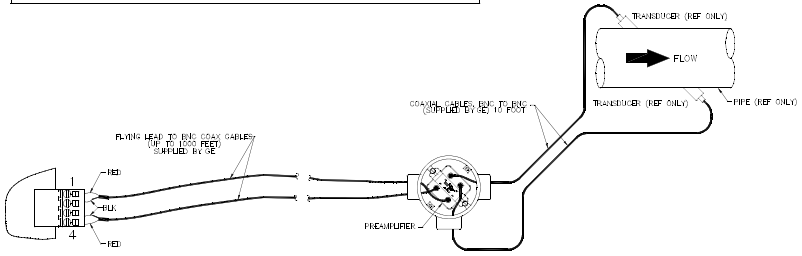
NOTE
One option card of each available type is shown in this diagram. These cards are not always installed in the same slots used for this example.

Figure 1-8: Model GF868 Electronics Console Wiring [Dwg. #702-213, Sh. 1]

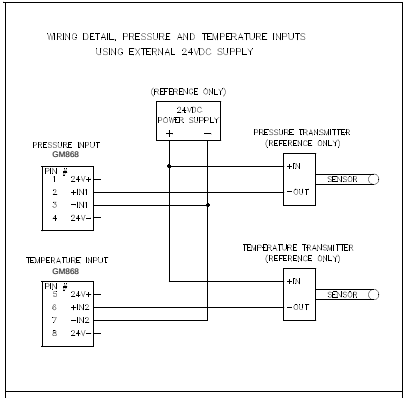


DUAL PREAMPLIFIER

CAUTION!
As part of maintaining the FM/CSA environmental rating (NEMA/TYPE 4) on the remote preamplifier, thread sealant is required on all conduit entries.



SINGLE PREAMPLIFIER



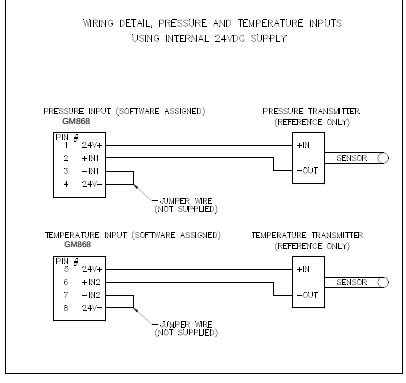


Figure 1-9: Model GF868 Transducer Wiring (Dwg. #702-213, Sh. 2)

Chapter 2

Initial Setup

Introduction 2-1

Navigating Through the User Program 2-1

Accessing the User Program 2-2

Activating a Channel 2-3

Entering System Data for a Channel 2-4

Entering Pipe Data 2-7

Introduction

This chapter provides instructions for entering the minimum amount of programming data required to place the GF868 flowmeter into operation. Before your GF868 can begin taking measurements, you must enter the necessary information into the SYSTM and PIPE submenus. In addition, a 2-Channel meter requires activation of each channel prior to use. The other submenus within the Program Menu enable you to access all the GF868 features; however, this information is not necessary to begin taking measurements.

Note: *See the* Programming Manual *for information on those User Program options not covered in this chapter.*

Navigating Through the User Program

To begin using the GF868, you must access three submenus within the User Program:

- ACTIV -enables you to select a measurement method.
- SYSTM - prompts you to enter the required system information.
- PIPE - lets you enter the necessary pipe data.

As a guide in following the programming instructions in this chapter, the relevant portions of the GF868 menu map appear in Figure 2-1 on page 2-10.

Note: *There are minor differences at the start of the* ACTIV *and* SYSTM *submenus for the 1-Channel and 2-Channel models, but the* PIPE *submenus are identical.*

The following discussion assumes that the left screen is active. If the right screen is active, only the function key designations change — [F1] becomes [F5], etc. Be sure to record all programming data in Appendix B, *Data Records.*

Use the keypad, as described in the *Programming Manual,* to navigate through the *User Program.* The menu map may be followed in sequence, or the [↑] and [↓] keys may be used to scroll through the prompt screens. The [←] key may be used to delete the last alphanumeric character that was entered from the keypad.

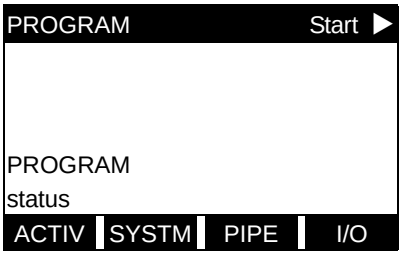
Accessing the User Program

To enter the Program Menu, press the [PROG] key on the keypad.

Note: *If the security feature is active, the GF868 will prompt you for a password. Enter the password and press* [ENT]. *See the* SECUR *submenu section in Chapter 1,* Programming Site Data, *of the* Programming Manual *for more information on the security feature.*

1-Channel Meter

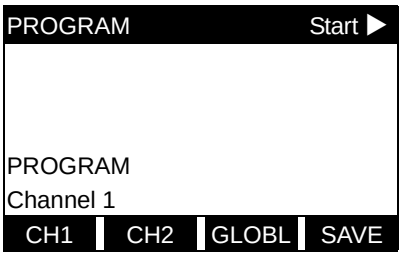
For a 1-Channel Model GF868, the measurement mode screen is replaced by the following initial programming mode screen:



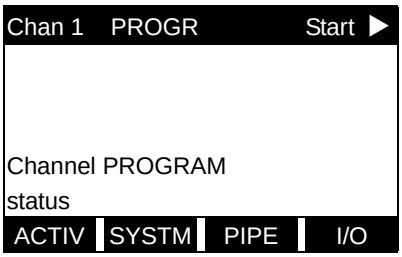
At the *User Program* screen shown, press the [F1] function key and proceed to *"Activating a Channel"* on the next page

2-Channel Meter

For a 2-Channel Model GF868, the following two-step sequence is required to reach the initial programming screen:



Press [F1] or [F2] to select the submenu for Channel 1 or Channel 2, respectively, from the option bar.



At the *User Program* screen shown, press the [F1] function key and proceed to *"Activating a Channel"* on the next page

Only the submenus ACTIV, SYSTM and PIPE are discussed in this manual. Refer to the *Programming Manual* for information on the other submenus.

Note: *In this manual, only the programming of Channel 1 will be described. To program Channel 2, simply repeat the same procedures presented for Channel 1.*

Activating a Channel

The ACTIV submenu permits selection of the desired measurement method. In addition, it is used to activate/deactivate one or both of the channels in a 2-Channel Model GF868.

1-Channel Meter

1. Enter the ACTIV submenu by pressing [F1] at the User PROGRAM prompt.
2. Press [F1] to activate the channel in BURST mode.

2-Channel Meter

1. Enter the ACTIV submenu by pressing [F1] at the Channel PROGRAM prompt.
2. Press [F1] (OFF) to deactivate the channel and return to the Channel PROGRAM prompt, or press [F2] to activate the channel in BURST mode.

1 and 2-Channel Meters

3. Press [F1] to select *Skan* mode or [F2] to select *Skan/Measure* mode. The meter will exit the ACTIV submenu and return to the channel menu screen.

As indicated in the above prompt, the Model GF868 flowmeter can take measurements in two different ways

Skan is a low resolution technique for locating the acoustic signal and for high velocity measurements. It is more robust in a noisy environment than the Measure technique.

Measure is a more precise technique best used for low velocity measurements.

If *Skan* is selected at the next prompt, the instrument uses this technique exclusively. However, if *S/M* is selected, the meter uses *Skan* to find the acoustic signal and then tries to use the *Measure* technique for a more precise measurement.

Proceed directly to the next section to program the SYSTM submenu.

Entering System Data for a Channel

Begin the programming of the SYSTM submenu in either the *1-Channel* or *2-Channel* section below.

A 1-Channel Meter

For the 1-Channel Model GF868, the information entered in the SYSTM submenu pertains to the global operation of the flowmeter.

1. At the *User Program* screen, press the [F2] function key to program the SYSTM submenu.
2. Enter a *Site Label* of up to 9 characters and press [ENT]. (While taking measurements, the site label will appear on the locator bar.)
3. Enter a *Site Message* of up to 21 characters. Press [ENT].
4. To select the *System Units*, press [F1] to display parameters and measurements in English units, or press [F2] to display parameters and measurements in Metric units.
5. Use the [F1]-[F4] keys to select the type of *Pressure Units* desired.

The abbreviations and definitions of all the available pressure units are shown in Table 2-1 below. The choices shown on the option bar are determined by the selections made at the previous SYSTEM UNITS prompt.

Table 2-1: Available Pressure Units

English	Metric
PSIa = Pounds per square inch absolute	BARa = bar absolute
PSIg = Pounds per square inch gage	BARg = bar gage
	kPaa = kiloPascals absolute
	kPag - kiloPascals gage

   a. If you have entered gage pressure, or the local atmospheric pressure (PSIg, BARg or kPag), use the numeric keys to enter the gage pressure value. Press [ENT].

6. At the *Stopwatch Totalizer* prompt, press [F1] to totalize all liquid flow continuously, or [F2] to measure totals manually with the Stopwatch Timer. (With MNUAL ([F2]), the console key on the keypad is used to start and stop the totalizer. See the *Programming Manual* for details.)

The remainder of the SYSTM submenu is identical for the 1-Channel and 2-Channel versions of the Model GF868. Proceed to the *1- and 2-Channel Meters* section to complete the programming of this submenu.

A 2-Channel Meter

For the 2-Channel Model GF868, the information entered in the SYSTM submenu pertains only to the currently selected channel.

1. At the *User Program* screen shown, press the [F2] function key to program the SYSTM submenu.
2. Enter a *Channel Label* of up to 9 characters. Press [ENT].
3. Enter a *Channel Message* of up to 21 characters. Press [ENT].

Note: *For the 2-Channel Model GF868, the System Units, Pressure Units and Stopwatch Totalizer prompts, which are not required to make the unit operational, are located in the GLOBL submenu. See the Programming Manual for details.*

The remainder of the SYSTM submenu is identical for the 1-Channel and 2-Channel versions of the Model GF868. Proceed to the *1- and 2-Channel Meters* section below to complete the programming of this submenu.

1 and 2-Channel Meters

1. Use the [F1]-[F4] and [→] keys to select the desired *Volumetric Units* for the flow rate display.

The abbreviations and definitions of all the available volumetric and totalizer units are shown in Table 2-2 below. The choices shown on the option bar are determined by the selection made at the previous SYSTEM UNITS screen.

Table 2-2: Available Volumetric/Totalizer Units

English	Metric
Actual Units	
ACF = Actual Cubic Feet	ACM = Actual Cubic Meters
KACF = Thousands of ACF	KACM = Thousands of ACM
MMACF = Millions of ACF	MMACM = Millions of ACM
Standard Units	
SCF = Standard Cubic Feet	SCM = Standard Cubic Meters
KSCF = Thousands of SCF	KSCM = Thousands of SCM
MMSCF = Millions of SCF	MMSCM = Millions of SCM

2. Use the [F1]-[F4] keys to select the *Volumetric Time* (units for the volumetric flow rate display).
3. Use the [F1]-[F4] keys to select the *Vol Decimal Digits* (the desired number of digits to the right of the decimal point) in the volumetric flow rate display.

1- and 2-Channel Meters (cont.)

4. Use the [F1]-[F4] and [→] keys to select the *Totalizer Units.*

The abbreviations and definitions of all the available volumetric and totalizer units are shown in Table 2-2 on the previous page. The choices shown on the option bar in the prompt screen above are determined by the selection made at the previous SYSTEM UNITS prompt screen.

5. Use the [F1]-[F4] keys to select the *Total Decimal Digits* (the desired number of digits to the right of the decimal point) in the totalized flow display.
6. Use the [F1]-[F4] keys to select the *Mass Flow* units, listed in Table 2-3 below.

Table 2-3: Available Mass Flow Units

English Mass Flow Units	Metric Mass Flow Units
LB- Pounds	KG - Kilograms
KLB - Thousands of Pounds	
MMLB - Millions of Pounds	
TONS -Tons	Tonnes - Metric Tons

7. Use the [F1]-[F4] keys to select the *Mass Flow Time* units.
8. Use the [F1]-[F4] keys to select the *MDOT DECIMAL DIGITS* (the number of digits to the right of the decimal point) for displaying mass flow.
9. Use the [F1]-[F4] keys to select the *Mass (Totalizer)* units, listed in Table 2-3 above.
10. Use the [F1]-[F4] to specify the *Mass Decimal Digits* (the number of digits to the right of the decimal point) for displaying totalized mass flow. The meter returns to the initial *User* (or *Channel) Program* screen.

Proceed directly to the next section to program the PIPE submenu.

Entering Pipe Data

The PIPE submenu permits entry of the transducer and pipe specifications. To program this menu, complete the following steps:

1. At the *User* (or *Channel) Program* screen, press [F3] to program the PIPE submenu.

Transducer Number

2. Enter the *Transducer Number* (normally engraved on the head of the transducer). Press [ENT]. If there is no engraved number, complete the steps below. Otherwise, proceed to step 3.

IMPORTANT: *Special transducers, which have no engraved number on the head, are rarely used. Examine the transducer head carefully for a number.*

   a. Assign a number between 91 and 99 to the *Special Transducer* and press [ENT]. (The meter will only accept values from 1 to 199.)

   b. Use the [→] and [F1]-[F4] keys to select the *Frequency* of the special transducer. The meter can not transmit an excitation voltage at the transducer's natural frequency without this data.

   c. Enter the special transducer *Time Delay (Tw)* value supplied by GE Sensing. Press [ENT]. (The meter will only accept values from 0 to 1000 µsec.)

Note: *Tw is the time required for the transducer signal to travel through the transducer and its cable. This time delay must be subtracted from the transit times of the upstream and downstream transducers to ensure an accurate measurement.*

Pipe OD

3. Enter the known *Pipe OD* or circumference and use the [F1]-[F4] keys to select the appropriate units. Press [ENT]. (The meter will only accept values from 1/8 to 648 in.) The option bar choices may appear in English or Metric units.

Obtain the required information by measuring either the pipe outside diameter (OD) or circumference at the transducer installation site. The data may also be obtained from standard pipe size tables. Table 2-4 below lists the available English and metric OD units.

Table 2-4: Available Pipe OD Units

English	Metric
inch = pipe OD in inches	mm = pipe OD in millimeters
feet = pipe OD in feet	m = pipe OD in meters
in/PI = pipe circumference in inches	mm/PI = pipe circumference in millimeters
ft/PI = pipe circumference in feet	m/PI = pipe circumference in meters

Pipe Wall

4. Use the numeric keys to enter the known thickness of the *Pipe Wall*. Press [ENT].

If the pipe wall thickness is not available, look up the value in a table of standard pipe size data or use the Model GF868's on-line *Help Menu* (see the *Programming Manual* for details).

Path Length

5. Press [F1] = inch or [F2] = feet to select the units. Then, enter the *Path Length (P)* of the ultrasonic signal. Press [ENT]. (The meter will only accept values from 1/8 to 900 in.)

Note: *GE Sensing has calculated both the transducer signal path length (P) and the transducer signal axial length (L), based on the exact transducer configuration used for the application. These values are engraved on the flowcell and/or are included in the documentation supplied with the meter.*

Axial Length

6. Press [F1] = inch or [F2] = feet to select the units.Then, enter the *Axial Length (L)* of the ultrasonic signal and press [ENT].

Note: *GE Sensing has calculated both the transducer signal path length (P) and the transducer signal axial length (L), based on the exact transducer configuration used for the application. These values are engraved on the flowcell and/or are included in the documentation supplied with the meter.*

Reynolds Correction

7. Press [F1] to turn *Reynolds Correction* off, or [F2] to turn it on.

Note: *Reynolds Correction is a number based on the Kinematic Viscosity and flow rate of the fluid. It should be enabled for most applications.*

   a. When you enable the Reynolds Correction Factor, you must also enter the *Kinematic Viscosity* of your gas, as listed in *Sound Speeds and Pipe Size Data*. Use the numeric keys to enter a value, and press [ENT].

8. Enter a value for the flow *Calibration Factor* and press [ENT]. The default value is 1.00. (The meter will only accept values from 0.5000 to 2.0000.)

Further Options

After completing the above steps, the meter returns to the User (or Channel) PROGRAM prompt. Continue as follows:

- To continue programming the meter, refer to the menu maps in Appendix A of the *Programming Manual* and navigate to the desired menu. Then, proceed to the appropriate section of the manual for instructions.
- To leave the *User Program* and retain the previous settings, press [EXIT] once (for a 1-channel GF868) or twice (for a 2-channel GF868) and then press [F1] = NO at the *SAVE* prompt. Any programming changes will be discarded and you will be returned to the data display.
- To leave the *User Program* and return to measurement mode, press [EXIT] once (for a 1-channel GF868) or twice (for a 2-channel GF868) and then press [F2] = YES at the *SAVE* prompt. Your programming changes will be entered into the meter's memory, and you will be returned to the data display.

Note: *See the* Programming Manual *for instructions on using the SAVE submenu.*

Proceed to Chapter 3, *Operation*, for instructions on taking measurements or refer to the *Programming Manual* for instructions on programming the Model GF868's advanced features.

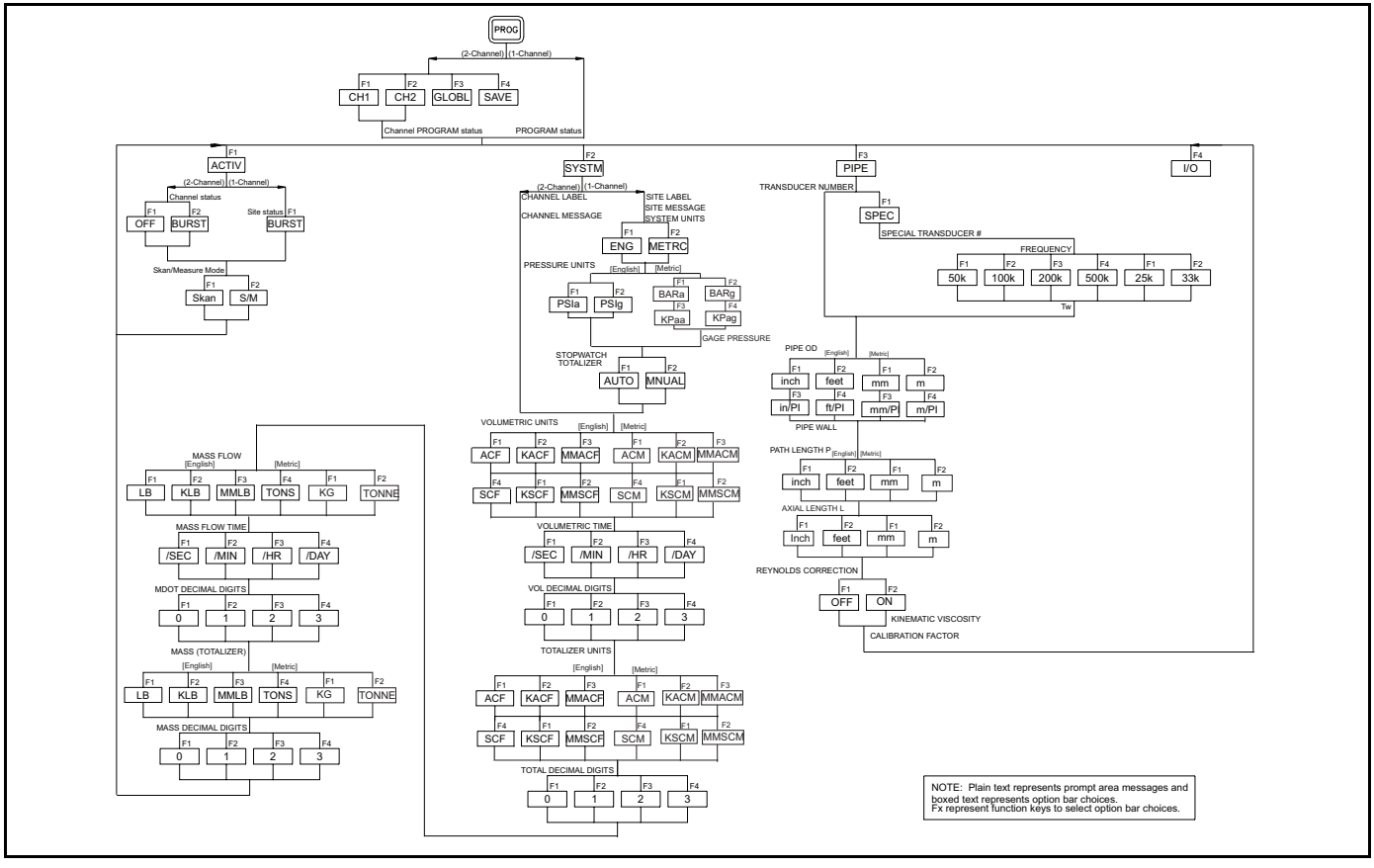


Figure 2-1: Model GF868 Initial Setup Menu Map

Chapter 3

Operation

Introduction 3-1

Powering Up 3-2

Using the Display 3-3

Taking Measurements 3-5

Introduction

See Chapter 1, *Installation*, and Chapter 2, *Initial Setup*, to prepare the system for operation. When the meter is ready to take measurements, proceed with this chapter. The following specific topics are discussed:

- Powering Up
- Using the Display
- Taking Measurements

Note: *All inputs and outputs of the Model GF868 are calibrated at the factory, prior to shipment. If it becomes necessary to recalibrate any of the inputs and/or outputs, see Chapter 1,* Calibration*, of the* Service Manual.

!WARNING!
To ensure the safe operation of the Model GF868, it must be installed and operated as described in this manual. In addition, be sure to follow all applicable local safety codes and regulations for the installation of electrical equipment.

Powering Up

Because the Model GF868 does not have an ON/OFF switch, it will power up as soon as the connected power source is energized.

Note: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the Model GF868. The power cord is the main disconnect device.*

Immediately upon power up, the Model GF868 displays "GE Sensing" and the software version in the left pane of the display window. The Model GF868 performs a series of internal checks and display the results in the right pane of the display window.

Note: *If the Model GF868 fails any of the internal checks, try disconnecting the power and then re-powering the unit. If the Model GF868 continues to fail any of the internal checks, contact the factory for assistance.*

After successfully performing the internal checks, the Model GF868 begins taking measurements. The power up display is replaced by a measurement mode display similar to that shown in Figure 3-1 below.

Note: *As a minimum, the system and pipe parameters (for each installed channel of a 2-channel meter) must be entered before the Model GF868 can display valid data. Refer to Chapter 2,* Initial Setup*, for specific instructions.*

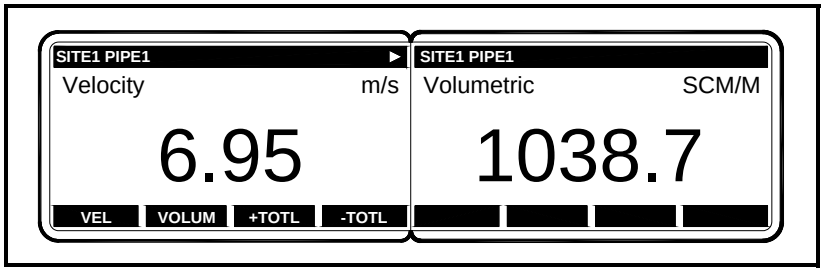


Figure 3-1: A Typical Measurement Display

Proceed to the next section for a description of the components of the Model GF868 display screen.

Using the Display

The Model GF868 display is divided into a left pane and a right pane. The two screen panes can be set independently to display any of the available measurement or diagnostic parameters. The components of a typical measurement mode screen are shown in Figure 3-2 below.

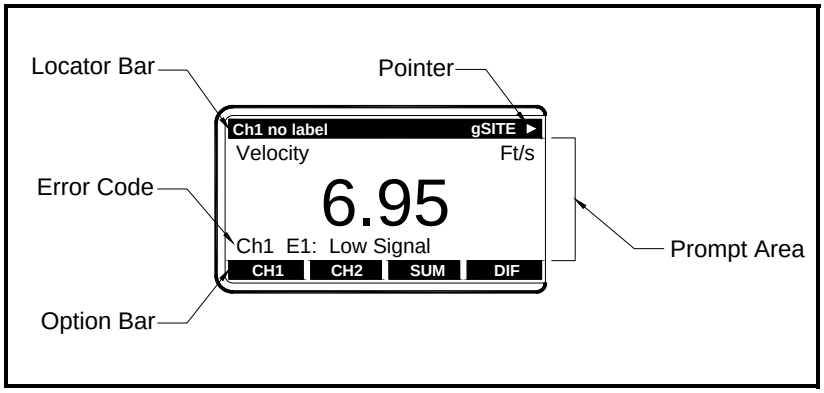


Figure 3-2: Display Screen Components

Both panes of the display screen are continuously updated, but only one pane at a time may be programmed or changed. To select a pane, press the corresponding side of the [SCREEN] key on the keypad. The currently selected screen pane will have function names in the option bar, while the other screen pane will have a blank option bar. See the *Programming Manual* for detailed instructions on using the keypad.

As shown in Figure 3-2 above, each pane of the display screen is divided into the following three general areas:

- the locator bar
- the prompt area
- the option bar.

The upper portion of the screen pane is called the *locator bar.* While the meter is taking measurements, the locator bar displays the name of the currently selected site file. In addition, the locator bar identifies the task that is currently being performed and the status of that task. For example, pressing the [PROG] key on the keypad will cause the locator bar to display "PROGRAM" and "Start" to indicate that the meter is ready to be programmed from the start of the *User Program*.

Using the Display (cont.)

At various times, one or more of the following four symbols may be displayed on the far right of the locator bar:

- ▶: This symbol, which is called the *pointer*, indicates that additional option bar entries are available. These options can be accessed by using the [←] and [→] keys.
- *: A flashing asterisk indicates that the Model GF868 is currently logging information. See the *Programming Manual* for instructions on creating a log file.
- S or S_L: This symbol indicates the status of the red [SHIFT] key. "S" indicates that the [SHIFT] key is activated for the next keystroke only, while "S_L" indicates that the [SHIFT] key is locked. See the next section for instructions on using the keypad.
- T: This symbol indicates that the Model GF868 is currently totalizing data.

The middle portion of the screen pane is the *prompt area*. This area displays data, graphs, and logs in measurement mode and menu prompts in programming mode. In addition, error code messages, which are described in the *Service Manual*, are displayed in the prompt area.

The lower portion of the screen pane is called the *option bar*. The option bar displays the functions assigned to the four keys immediately below the display screen ([F1]-[F4] for the left pane and [F5]-[F8] for the right pane). Press a function key to select the function listed in the option bar immediately above it. If more than four functions are available, a pointer (▶) appears on the far right of the locator bar. Press the [←] or [→] keys to display the additional functions on the option bar.

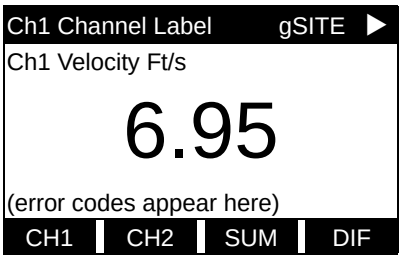
For information about other symbols and text that may appear on the display screen, refer to the *Service Manual*.

Taking Measurements

The Model GF868 is capable of displaying several different variables in a variety of formats. However, this manual will only discuss the basic measurement displays in the default screen format. Refer to the *Programming Manual* for instructions on setting up alternate screen displays and see the *Service Manual* for a discussion of the diagnostic parameters listed under the DIAG option.

Note: *This section assumes that the left pane of the display screen is currently active. However, the same instructions apply equally to the right screen pane, when it is active. Just change the function keys from* [F1]-[F4] *to* [F5]-[F8].

For a 2-channel Model GF868, the following initial screen appears immediately upon completion of the internal checks. As an example, the display shows the measured velocity in ft/sec for Channel 1.

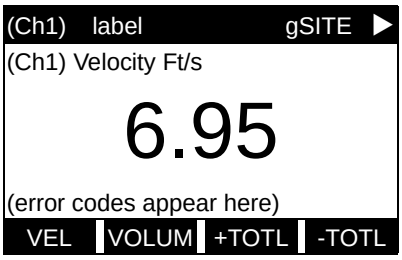


To select a different channel display option, press [F1]-[F4] (or [→] and [F1]). See Table 3-1 below for a complete description of the available options.

Table 3-1: Channel Display Options

Option Bar Choice	Description
[F1] = CH1	Channel 1
[F2] = CH2	Channel 2
[F3] = SUM	(Channel 1) + (Channel 2)
[F4] = DIF	(Channel 1) - (Channel 2)
[→] + [F1] = AVE	[(Channel 1) + (Channel 2)]/2

The following screen appears after selection of the channel mode display option for a 2-channel Model GF868 or immediately after the internal checks for a 1-channel Model GF868.



Use the [F1]-[F4], [←] and [→] keys to select the desired display parameter option. See Table 3-2 on page 3-6 for a complete description of the available options.

Taking Measurements (cont.)

Note: *Ch1 (or Ch2), which is shown in parentheses above, appears only with a 2-Channel Model GF868.*

Table 3-2: Measurement Parameter Options

Option Bar Choice	Description
[F1] = VEL	Flow Velocity
[F2] = VOLUM	Volumetric Flow
[F3] = +TOTL	Forward Totalized Volume Flow
[F4] = -TOTL	Reverse Totalized Volume Flow
[→] + [F1] = TIME	Total Flow Measurement Time
[→] + [F2] = MDOT*	Mass Flow
[→] + [F3] = +MASS*	Forward Totalized Mass Flow
[→] + [F4] = -MASS*	Reverse Totalized Mass Flow
[→] + [→] + [F1] = DIAG	Diagnostic
* Available only if Mass Flow (static)? = YES	

By following the instructions in this section, the Model GF868 can be set up to display the desired channel option (for a 2-Channel meter) and the desired measurement parameter. To utilize the more advanced display capabilities of the Model GF868, refer to the *Programming Manual* and/or the *Service Manual* for the instrument.

Foundation Fieldbus Communications

Foundation Fieldbus provides a means of communicating with the flowmeter. The patent numbers which apply are 5,909,363 and 6,424,872.

This Foundation Fieldbus device supports two Analog Input (AI) blocks, which can be configured to supply the following measurements on the network (see Table 3-3 on page 3-7).

Table 3-3: Measurement Parameter Options Using a Foundation Fieldbus Device

Channel 1	Units	Channel 2	Units	Average	Units
Ch1 Velocity	ft/s or m/s*	Ch2 Velocity	ft/s or m/s*	Avg Velocity	ft/s or m/s*
Ch1 Act Volumetric	VOL_U	Ch2 Act Volumetric	VOL_U	Avg Act Volumetric	VOL_U
Ch1 Std Volumetric	VOL_U	Ch2 Std Volumetric	VOL_U	Avg Std Volumetric	VOL_U
Ch1 Fwd Totals	TOT_U	Ch2 Fwd Totals	TOT_U	Avg Fwd Totals	TOT_U
Ch1 Rev Totals	TOT_U	Ch2 Rev Totals	TOT_U	Avg Rev Totals	TOT_U
Ch1 #Tot Digits**	none	Ch2 #Tot Digits**	none	Avg #Tot Digits**	none
Ch1 Mass Flow	MASS_U	Ch2 Mass Flow	MASS_U	Avg Mass Flow	MASS_U
Ch1 Fwd Mass Totals	MTOT_U	Ch2 Fwd Mass Totals	MTOT_U	Avg Fwd Mass Totals	MTOT_U
Ch1 Rev Mass Totals	MTOT_U	Ch2 Rev Mass Totals	MTOT_U	Avg Rev Mass Totals	MTOT_U
Ch1 #Mass Tot Digits	none	Ch2 #Mass Tot Digits	none	Avg #Mass Tot Digits	none
Ch1 Timer	sec	Ch2 Timer	sec	Avg Timer	sec
Ch1 Error Code	none	Ch2 Error Code	none	Avg Error Code	none
Ch1 SSUP	none	Ch2 SSUP	none	Avg SSUP	none
Ch1 SSDN	none	Ch2 SSDN	none	Avg SSDN	none
Ch1 Sound Speed	ft/s or m/s*	Ch2 Sound Speed	ft/s or m/s*	Avg Sound Speed	ft/s or m/s*
Ch1 Density***	see note	Ch2 Density***	see note		
Ch1 Temperature	Deg F or C*	Ch2 Temperature	Deg F or C*		
Ch1 Pressure	PRESS_U	Ch2 Pressure	PRESS_U		

*Metric or English units are determined by the setup of the flowmeter.

**Totalizer digits are available for informational purposes only. Respective totals are automatically scaled by the Tot Digits value selected in the flowmeter setup.

***If the meter is outputting Mole Weight, the unit is “mw”, otherwise it is the programmed pressure unit.

VOL_U, TOT_U, MASS_U, MTOT_U and PRESS_U are determined by the units chosen for these measurements in the flowmeter setup. See the instrument User's Manual for the setup of these parameters.

Chapter 4

Specifications

General Specifications 4-1

Electrical Specifications 4-2

Operational Specifications. 4-4

Transducer/Flowcell Specifications 4-5

Flowcell Specifications 4-5

General Specifications

The general specifications for the Model GF868 flowmeter are divided into the following categories:

Hardware Configuration

Package Options:
Epoxy-coated aluminum (standard)
Stainless steel (optional)
Fiberglass (optional)
Explosion-proof (optional)
Flameproof (optional)

Physical: (Epoxy-coated aluminum package)
Size: 14.24 × 11.4 × 5.12 in. (36.2 × 29 × 13 cm)
Weight: 11 lb (5 kg)

Environmental

Operating Temperature:

-4° to 131°F (–20° to 55°C)

Storage Temperature:

–67° to 167°F (–55° to 75°C)

Flow Accuracy (% of Reading)

Velocity Accuracy:

1-Path Measurement
±2% to 5% of reading at ±1 to ±275 ft/s (±0.3 to ±85 m/s)

2-Path Measurement
±1.4% to 3.5% of reading at ±1 to ±275 ft/s (±0.3 to ±85 m/s)

Note: *Specifications assume a fully developed flow profile. This is installation-dependent and may require a straight run of pipe 20 diameters upstream and 10 diameters downstream. Accuracy depends on whether measurement is 1- or 2-path.*

Range

Bi-directional:
–275 to –0.1 ft/s (–85 to –0.03 m/s)
+0.1 to 275 ft/s (0.03 to 85 m/s)

Molecular Weight and Mass Flow Accuracy (% of Reading)

Molecular Weight (hydrocarbon mixtures):
MW 2 to 120 g/mol.
1.8%, optimizable for other gas composition

Mass Flow (hydrocarbon mixtures, typical):
1-path: 3 to 7%
2-path: 2.4 to 5%

Note: *Dependent on accuracy of temperature and pressure inputs.*

Rangeability

2750:1

Repeatability

±1% at 0.5 to 100 ft/s (15 cm/s to 30 m/s)

Electrical Specifications

Power Supply

Input Options:
100 to 130 VAC, 50/60 Hz with 1.0 A Slo-Blo Fuse
200 to 265 VAC, 50/60 Hz with 0.5 A Slo-Blo Fuse
12 to 28 VDC with 3.0 A Slo-Blo Fuse

Power Usage

20 W maximum

Protection

Built-in mains power surge/lightning protection.

European Compliance

This unit complies with EMC Directive 89/336/EEC and 73/23/EEC Low Voltage Directive (Installation Category II, Pollution Degree 2), and PED 97/23/EC for DN<25.

Input/Output Specifications

Keypad:

39-key membrane keypad with tactile feedback

Display:

Two independent software-configurable 64 x 128-pixel LCD graphic displays

Printer/Terminal Communications:

One RS-232 port for printer, terminal, PC, SCADA, etc.

Standard Inputs:

Two isolated 4 to 20 mA inputs (121 Ω load) with integral 24 VDC power supply

Note: *These inputs are required for temperature and pressure inputs.*

Standard Outputs

Six 4-20 mA outputs, software assignable
Two outputs for 550 ohm maximum load
Four outputs for 1000 ohm maximum load.

Measurements
(assignable to any output):
Velocity: 0 to 275 ft/s (0 to 85 m/s)
Volumetric flow rate: standard or actual
Molecular weight: 2 to 120 g/mol
Sound speed: 500 to 5000 ft/s (150 to 1500 m/s)
Mass flow rate: 0 to 4,000,000 lb/h (0 to 2,000,000 kg/h)

Input/Output Specifications (cont.)

Analog Input Options:

Select up to 3 boards from one of the following types:

1. *Transmitter Input Board* with two isolated 0/4-20 mA inputs and 24-V loop power.
2. *RTD Input Board* with two isolated 3-wire RTD inputs; Span –148° to 662°F (–100° to 350°C)

Analog Output Options:

Select up to 3 additional output boards, each with four isolated 4–20 mA outputs (1000 Ω maximum load).

Digital Interfaces:

Standard: RS232
Optional: RS485 (multiuser)
RS485 (MODBUS)
HART
Ethernet TCP/IP
MODBUS TCP/IP (Ethernet)

Totalizer/Frequency Output Options:

Select up to 3 Totalizer/Frequency Output Boards, each with four outputs per board, 10 kHz max.

All boards allow software-selectable functioning in two modes:

Totalizer Mode: one pulse per defined unit of parameter (e.g., 1 pulse/SCF).

Frequency Mode: 5-volt frequency proportional to magnitude of parameter (e.g., 10 Hz = 1 SCFM).

Alarm Options:

Select up to 2 boards of one of the following types:

Standard Relay Board with three non-hermetic Form-C relays.

Hermetic Relay Board with three hermetically sealed Form-C relays.

Operational Specifications

Flow Computer (Built-in)	Programmable from the keypad. Calculates velocity, instantaneous average molecular weight, mass flow rate, and other flow parameters in real time, while simultaneously handling other activities such as programming, logging, calibration, and output of data and diagnostics. New and improved MW algorithm, now based on temperature and pressure correction of sound speed. Gives wider range, higher accuracy, and improved compensation for non-hydrocarbon gases such as CO_2, H_2, N_2, and CO.
Data Logging	Keypad-programmable for setting up log units, update interval, start and stop times. Memory capacity for more than 43,000 data points in a linear or circular log for standard and error logs.
Display Functions	Graphic display shows flow in numeric or graphic format. Also displays logged data and diagnostics.
Printer Signal Output	Supports wide variety of thermal and impact printers. Output data in numeric or graphic (“strip chart”) format.

Transducer/Flowcell Specifications

Transducer Type	Standard GE Sensing type T5 (welded assembly of Ti transducer). For agency certifications, contact GE Sensing.
Temperature Range	Standard: –94° to +300°F (–70° to 150°C) Optional high temperature: –94° to +536°F (–70° to +280°C) Optional low temperature: –364° to +248°F (–220° to +120°C)
Pressure Range	0 to 1500 psig (1 to 1.5 bar)
Materials	Standard: Titanium Optional: Monel®, Hastalloy®, and 316 stainless steel
Connections	**Cable Length:** Up to 1000 ft (300 m) **Housing Options:** Explosion-proof (Type-7, Class I, Group C & D, Division I.) Weatherproof (Type-4X, IP65) Flameproof (Ex II 2 G EEx d II C T6)
Mounting and Installation	Mechanical insertion mechanism rated to 500°F and 500 psig.

Flowcell Specifications

Spoolpiece	Prefabricated spools complete with transducer/mechanism port: Pipe sizes: 3 to 120 in. Process Connections: Plain end; 150, 300, or 600 lb. RF flanged. Materials: carbon steel, low-carbon steel, stainless steel, or other.
Hot/Cold Tap	Mechanisms installed via hot or cold tap. Full installation jigs, fittings, and documentation provided. Process Connections: NA
Preamplifier with Explosion-proof Housing	Operating Temperature: -40° to +140° (-40° to +60°C)

Appendix A

CE Mark Compliance

Introduction A-1

Wiring A-1

Introduction

For CE Mark compliance, the Model GF868 flowmeter must be wired in accordance with the instructions in this appendix.

IMPORTANT: *CE Mark compliance is required only for units intended for use in EEC countries.*

Wiring

The Model GF868 must be wired with the recommended cable, and all connections must be properly shielded and grounded. Refer to Table A-1 below for the specific requirements.

Table A-1: Wiring Modifications

Connection	Cable Type	Termination Modification
Transducer	RG62 a/u	Add metallic cable clamp from braid to chassis ground.
	Armored RG62 a/u or conduit	None - grounded via cable gland.
Input/Output	22 AWG shielded (e.g. Baystate #78-1197)	Terminate shield to chassis ground.
	Armored conduit	None - grounded via cable gland.
Power	14 AWG, 3 conductor, shielded (e.g. Belden #19364)	None required
	Armored Conduit	None - grounded via cable gland.
Shielding	For CE compliance, power and I/O cables must be shielded. Cables to be terminated within cable gland at the GF868. Shielded cable is not required when installations include metal conduit.	

Note: *If the Model GF868 is wired as described in this appendix, the unit will comply with the EMC Directive 89/336/EEC.*

Appendix B

Data Records

Option Cards Installed B-1

Initial Setup Data B-2

Option Cards Installed

Whenever an option card is installed in one of the Model GF868's expansion slots, record the type of card and any additional setup information in the appropriate row of Table B-1 below.

Table B-1: Option Cards Installed

Slot #	Type of Option Card	Additional Setup Information
0	Analog Outputs (A, B)	
1		
2		
3		
4		
5		
6		

Initial Setup Data

After the Model GF868 flowmeter has been installed, some initial setup data must be entered via the *User Program*, prior to operation. Record that information in Table B-2 below.

Table B-2: Data Information Sheet

General Information						
Model #				Reference		
Software Vers.				Date		
Serial #				Z Dimension		
Measurement Method (1-Channel) - *ACTIV*						
Site Status	Burst			Measure Mode	Skan	S/M
Measurement Method (2-Channel) - *ACTIV*						
Channel 1				Channel 2		
Channel Status	Off	Burst		Channel Status	Off	Burst
Measure Mode	Skan	S/M		Measure Mode	Skan	S/M
System Parameters - *SYSTEM*						
1-Channel				2-Channel		
Site Label				Chan.1 Label		
Site Message				Chan. 1 Message		
System Units	English	Metric		Chan. 2 Label		
Pressure Units				Chan. 2 Message		
Stopwatch Total.	Auto	Manual				
1-Channel and 2-Channel						
Channel 1				Channel 2 (if applicable)		
Vol. Units				Vol. Units		
Vol. Time Units				Vol. Time Units		
Vol. Dec. Digits				Vol. Dec. Digits		
Totalizer Units				Totalizer Units		
Tot. Dec. Digits				Tot. Dec. Digits		
Mass Flow				Mass Flow		
Mass Flow Time				Mass Flow Time		
MDOT Dec. Dig.				MDOT Dec. Dig.		
Mass Totalizer				Mass Totalizer		
Mass Dec. Dig.				Mass Dec. Dig.		
Pipe/Transducer Parameters - *PIPE*						
Channel 1				Channel 2 (if applicable)		
Std. Trans. #				Std. Trans. #		
Spec. Trans. #				Spec. Trans. #		
Spec. Trans. Hz				Spec. Trans. Hz		
Spec. Trans. Tw				Spec. Trans. Tw		

Note: table is continued on the next page.

Table B-2: Data Information Sheet (Continued)

Pipe/Transducer Parameters (cont.) - *PIPE*					
Channel 1 (cont.)			Channel 2 (cont.)		
Pipe O.D.			Pipe O.D.		
Pipe Wall			Pipe Wall		
Path Length (P)			Path Length (P)		
Axial Length (L)			Axial Length (L)		
Multi K-factors	Off	On	Multi K-factors	Off	On
Edit Table	No	Yes	Edit Table	No	Yes
K-factor Table			**K-factor Table**		
K-Factor #	Velocity	K-Factor	K Factor #	Velocity	K-Factor
1			1		
2			2		
3			3		
4			4		
5			5		
6			6		
7			7		
8			8		
9			9		
10			10		
11			11		
12			12		
13			13		
14			14		
15			15		
16			16		
17			17		
18			18		
19			19		
20			20		

Appendix C

Optional Enclosures

Introduction. C-1

Rack Mount Enclosure. C-1

Rack Mount Wiring C-1

Rack Mount Front Panel C-2

Introduction

Upon request the Model GF868 flowmeter may be supplied in an enclosure other than the standard Type-4X enclosure described in Chapter 1, *Installation*, of this manual. Although the standard installation and wiring instructions still apply in general terms, some of the details may vary for different enclosure types. Refer to the appropriate sections of this appendix for the specific type of enclosure provided.

Rack Mount Enclosure

The Model GF868 flowmeter is available in a *rack mount* enclosure for installation in a standard 19" electronics rack. Refer to Figure C-1 on page C-3 for the dimensions of this unit. Simply slide the Model GF868 into the rack at the desired height and fasten the unit securely to the rack with four screws in the locations provided at the sides of the front panel.

After the unit has been physically mounted into the rack, proceed to the next section for instructions on wiring the meter.

Rack Mount Wiring

The rack mount Model GF868 requires exactly the same electrical connections as the standard version. However, the locations and type of connectors used for the various components are different. Refer to Figure C-2 on page C-4 and complete the following steps:

1. Wire the *power input* on the right side of the rear panel as follows:
   a. Make sure a *fuse* (item #4) of the proper size and type is installed.
   b. Connect the female end of the *line cord* provided to the power input receptacle (item #3).
   c. Connect the *earth ground* screw terminal (item #2) to a ground point on the rack.
2. Wire the *transducers* as follows:
   a. Connect the pair of cables supplied with the meter to the *Channel 1* upstream and downstream BNC transducer connectors on the left side of the rear panel.
   b. For a 2-Channel meter, repeat the above step for the *Channel 2* transducer connectors (if the second channel is to be used).
   c. Complete the transducer wiring in accordance with the instructions in Chapter 1, *Installation*, of this manual.

Rack Mount Wiring (cont.)

3. Wire the 0/4-20 mA *analog outputs* at the left side of the rear panel in accordance with the instructions in Chapter 1, *Installation*, of this manual.
4. Wire the *RS232 serial port* by completing the following steps:
   a. Purchase or prepare a suitable serial cable. This cable should have a standard female DB9 connector, wired as shown in Figure C-2 on page C-4, for connection to the rear panel of the Model GF868. The other end should be as required for the external device.
   b. Complete the serial port wiring in accordance with the instructions in Chapter 1, *Installation*, of this manual.
5. Wire any installed *option cards* using the same procedures described in Chapter 1, *Installation*, of this manual and the pin # assignments shown in Figure C-2 on page C-4.
6. Place the *power switch* (item #1) in the ON position.

The Model GF868 is now completely wired. Proceed to Chapter 2, *Initial Setup*, of this manual for further instructions.

Rack Mount Front Panel

The keypad and LCD display for the rack mount Model GF868 are located on the front panel. These items are identical in form and function to those used on the standard Type-4X enclosure, but the layout is somewhat different.

Refer to Figure C-3 on page C-5 for the front panel layout of the rack mount Model GF868 and follow the standard procedures detailed in the main body of this manual.

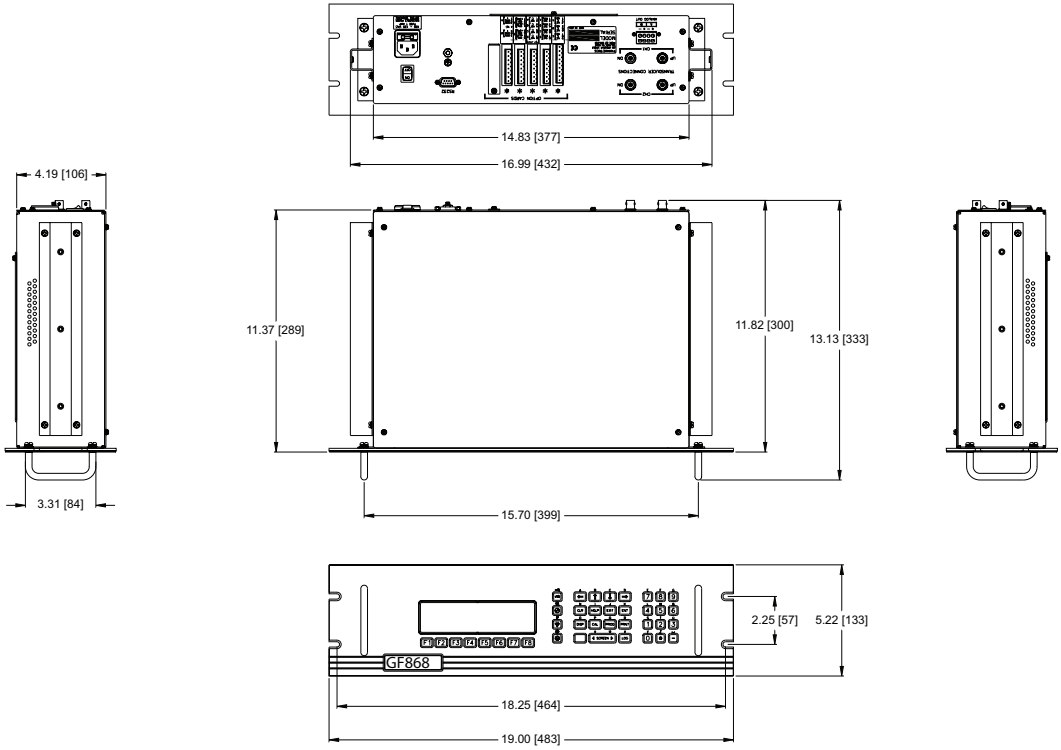


Figure C-1: Model GF868 Rack Mount Enclosure (Dwg. #712-1078)

CH2 TRANSDUCER	
BNC #	Description
UP	Upstream XDCR
DN	Downstream XDCR

CH1 TRANSDUCER	
BNC #	Description
UP	Upstream XDCR
DN	Downstream XDCR

0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - SIG(+)
2	Output A - RTN(-)
3	Output B - SIG(+)
4	Output B - RTN(-)

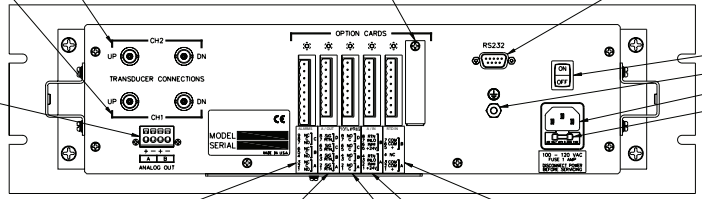
NOTE

One option card of each available type is shown in this diagram. These cards are not always installed in the same slots used for this example.

NOTE: *For compliance with the European Union's Low Voltage Directive (73/23/EEC), this unit requires an external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible and located within 1.8 m (6 ft) of the Model GF868.*

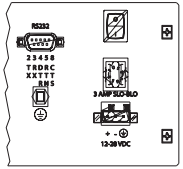
RS232 SERIAL PORT (DB9)	
Pin #	Description
1	No Connection
2	TX - Transmit
3	RX - Receive
4	DTR - Data Terminal Ready
5	RTN - Digital Return
6	No Connection
7	No Connection
8	CTS - Clear to Send
9	No Connection

Covered Option Card Slot



POWER INPUT	
Item #	Description
1	ON/OFF Switch
2	Earth Ground
3	Power Cord
4	Fuse

REAR-VIEW DC OPTION



ALARM RELAYS	
Pin #	Description
1	Relay A - Normally Open (NO)
2	Relay A - Common (C)
3	Relay A - Normally Closed (NC)
4	Relay B - Normally Open (NO)
5	Relay B - Common (C)
6	Relay B - Normally Closed (NC)
7	Relay C - Normally Open (NO)
8	Relay C - Common (C)
9	Relay C - Normally Closed (NC)

0/4-20 mA ANALOG OUTPUTS	
Pin #	Description
1	Output A - RTN(-)
2	Output A - SIG(+)
3	Output B - RTN(-)
4	Output B - SIG(+)
5	Output C - RTN(-)
6	Output C - SIG(+)
7	Output D - RTN(-)
8	Output D - SIG(+)

TOTALIZER/FREQUENCY OUTPUTS	
Pin #	Description
1	Output A - Common (C)
2	Output A - Normally Open (NO)
3	Output B - Common (C)
4	Output B - Normally Open (NO)
5	Output C - Common (C)
6	Output C - Normally Open (NO)
7	Output D - Common (C)
8	Output D - Normally Open (NO)

0/4-20 mA ANALOG INPUTS	
Pin #	Description
1	Input A - +24V
2	Input A - INHI
3	Input A - INLO
4	Input A - RTN
5	Input B - +24V
6	Input B - INHI
7	Input B - INLO
8	Input B - RTN

RTD INPUTS	
Pin #	Description
1	Input A - SIG(+)
2	Input A - Common (C)
3	Input A - Common (C)
4	Unused
5	Input B - SIG(+)
6	Input B - Common (C)
7	Input B - Common (C)
8	Unused

Figure C-2: Model GF868 Rack Mount Enclosure - Wiring Diagram

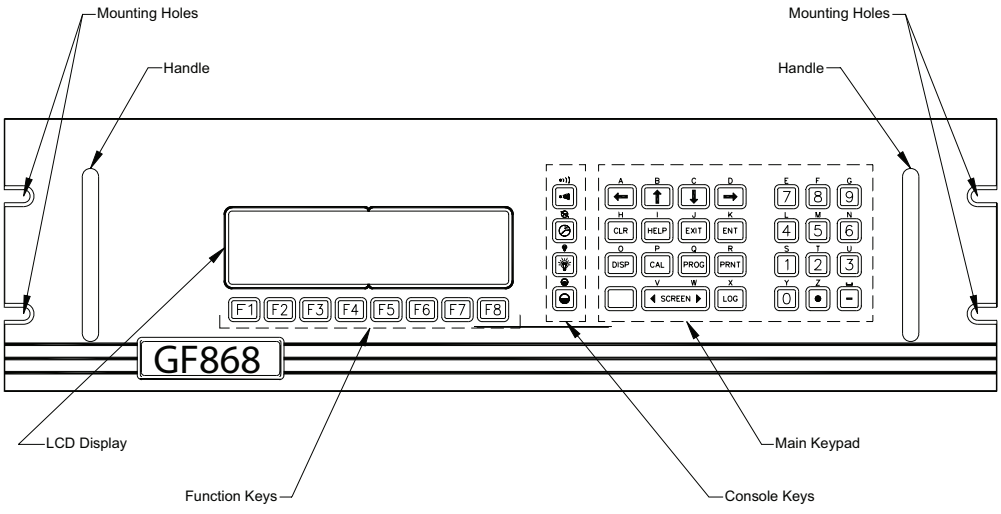


Figure C-3: Model GF868 Rack Mount Enclosure - Front Panel Layout

Appendix D

Measuring P and L Dimensions

Introduction. D-1

Measuring P and L Distances D-1

Introduction

When programming the PIPE menu of the Model GF868's *User Program*, the *path length* (P) and the *axial dimension* (L) must be entered. These parameters are determined by measurements on the actual transducer installation, with P equal to the face-to-face distance between the transducers and L equal to the axial distance between the centers of the transducer faces.

The accuracy of the programmed P and L values is critical to precise flow rate measurements. If GE Sensing supplies the flowcell for the system, the correct values will be included in the documentation supplied with the unit. For transducers installed on an existing pipe (see Figure D-1 on page D-2), P and L must be measured at the site. This appendix provides instructions for properly determining these dimensions.

Measuring P and L Distances

Whenever possible, physically measure the face-to-face distance (P) and the axial distance (L) between the centers of the flat faces of the transducers. Refer to Figure D-1 on page D-2 for an illustration of the proper distances to measure in a typical installation.

In some situations only one of the required distances can be directly measured. When this happens, a knowledge of the installation angle (θ) of the transducers, permits the second distance to be calculated from Equation D-1 below:

$$\cos\theta = \frac{L}{P} \qquad \text{(D-1)}$$

As an example, assume that the transducer installation angle is known to be 45° and the L distance is measured to be 10.00 inches. Then, the P distance is calculated to be P = 10.00/0.707 = 14.14 inches.

With a Bias 90° transducer installation, it sometimes happens that the only known parameters are the transducer angle (θ) and the centerline distance between the transducer bodies (CL). In these cases, it is still possible to calculate both P and L by combining Equation D-1 above with additional Equation D-2 below (see Figure D-1 on page D-2):

$$P = CL - 1.2 \qquad \text{(D-2)}$$

Standard GE Sensing 90° transducers have the face offset from the centerline of the body by 0.6 inches. Thus, a pair of transducers has a total offset of 1.2 inches, as indicated in Equation D-2 above. For example, suppose that the transducer installation angle is 30° and CL is measured to be 12.00 inches. Then, P = 12.00 – 1.2 = 11.80 inches and L = 11.80 x 0.866 = 10.93 inches.

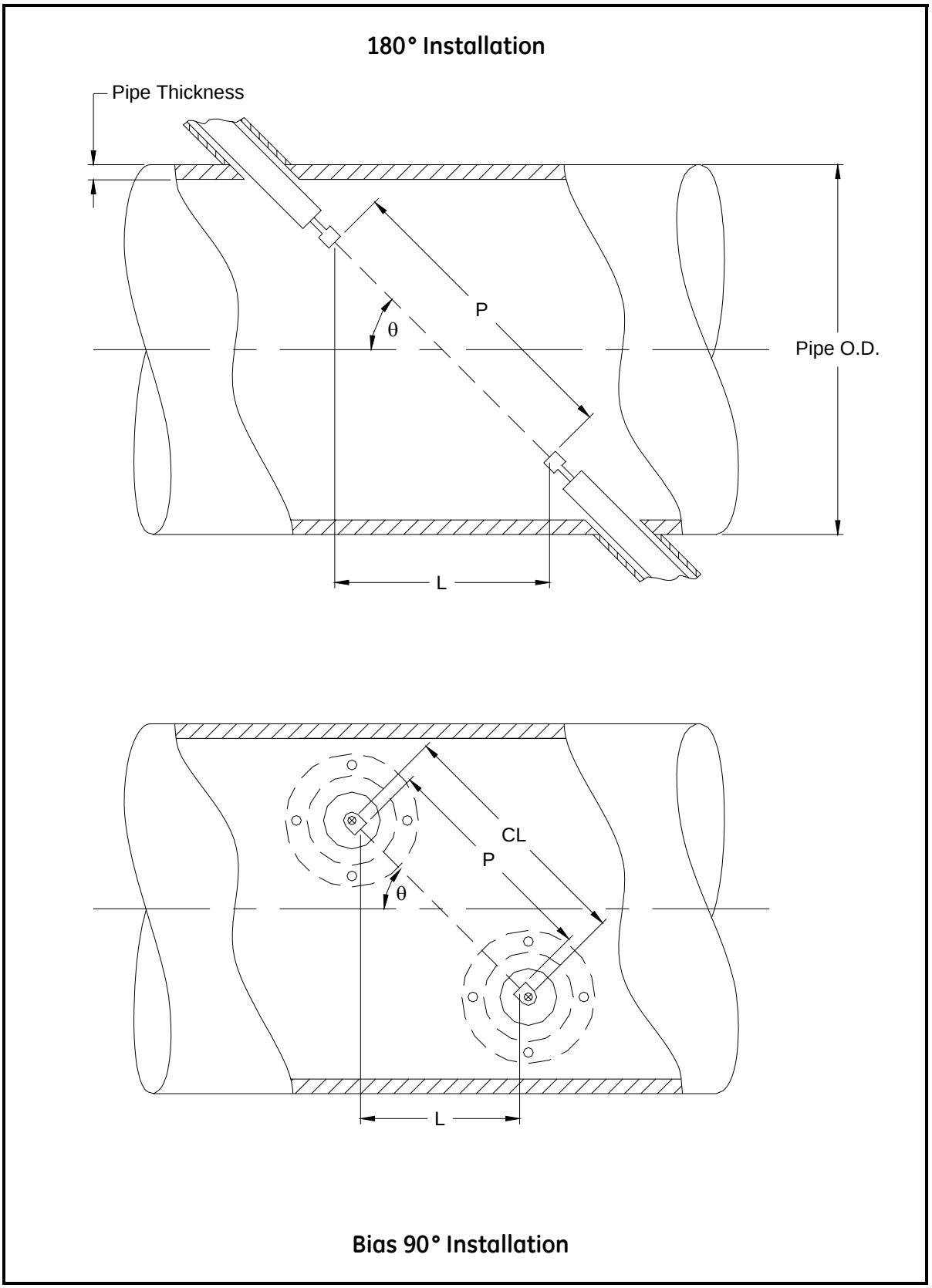


Figure D-1: Top View of Transducer Installations

Index

A

Abbreviations, Volumetric & Totalizer Units 2-5
ACTIV Submenu 2-3
Alarm Options 4-3
Alarms Option Card
  Pin Assignments. 1-16
Analog Inputs Option Card
  Ratings 4-3
Analog Outputs (Slot 0)
  Pin Assignments. 1-16
Analog Outputs Option Card
  Pin Assignments. 1-16
Axial Dimension D-1

C

CE Mark Compliance. A-1
Configuration, Hardware 4-1

D

Data Logging 4-4
Digital Interfaces for GF868 4-3
Display
  Channel Mode Options 3-5
  Components 3-3
  Data 3-2
  Locator Bar. 3-3
  Locator Bar Symbols 3-4
  Measurement Mode 3-2
  Option Bar 3-3
  Parameter Options 3-6
  Pointer 3-3
  Prompt Area 3-3
  Selecting. 3-3
  Using 3-3
Display Functions. 4-4

E

Electronics Console
  Mounting 1-15
European Compliance of GF868 4-2

F

Fieldbus Network 1-12
  Connections. 1-12
Flow Accuracy 4-1
Flow Computer 4-4
Function Keys 3-4
Fuse Ratings 4-2

H

Hardware Configuration 4-1

I

Initial Setup
  Data Table B-2
Input/Output Specifications 4-2
Installation Instructions for CE Mark
Compliance A-1
Internal Tests. 3-2

K

Kinematic Viscosity 2-8

L

Locator Bar 3-3

M

Mass Flow Accuracy. 4-1
Measurement Outputs 4-2
Measurements
  Displaying 3-2, 3-5
  Parameter Options. 3-6
  Taking 3-2, 3-5
MODBUS/TCP, Wiring the 1-11
Molecular Weight 4-1

O

Operating Temperature 4-1
Option Bar. 3-3
Option Card
  Setup Information Table B-1

Index (cont.)

P

Parameter Options 3-6
Path Length. D-1
Pipe OD, Available Units 2-7
Pipe OD,Programming 2-7
PIPE Submenu 2-7
Pointer. 3-3
Power
  Terminal Block 1-16
Power Supply 4-2
Power Usage. 4-2
Powering Up
  Display 3-2
  Internal Checks. 3-2
Pressure Range 4-5
Printer Signal Output 4-4
Printer/Terminal Communications 4-2
Programming Data
  Record. B-1
Prompt Area 3-3
Protection, Electrical. 4-2

R

Rack Mount
  Front Panel C-2, C-5
  Installation C-1, C-3
  Wiring. C-1, C-4
Range 4-1
Rangeability 4-1
Repeatability. 4-1
Reynolds Correction. 2-8
RS232 Port
  See Serial Port
RTD Inputs Option Card
  Pin Assignments 1-16

S

Screen, Selecting 3-3
Serial Port
  Connecting. 1-9
  Pin Assignments 1-9, 1-16
Specifications
  Electrical 4-2
  General 4-1
  Input/Output 4-2
  Mass Flow Accuracy 4-1
  Molecular Weight 4-1
  Operational 4-4
  Range. 4-1
  Rangeability. 4-1
  Repeatability 4-1
  Transducer/Flowcell 4-5
Standard Outputs 4-2
Storage Temperature 4-1
Symbols, Locator Bar 3-4
SYSTM Submenu 2-4
  for 1-Channel Meter 2-4
  for 2-Channel Meter 2-5

Index (cont.)

T

Temperature Range 4-5
Terminal Block
Analog Outputs - I/O 1-16, C-4
Power - TB1 . . . . . 1-16, C-4
Serial Port - RS232. . . . . 1-9, 1-16, C-4
Transducers - CH1/CH2. . . . . 1-16, C-4
Totalizer/Frequency Option Card
Pin Assignments. 1-16, C-4
Totalizer/Frequency Output Options 4-3
Transducer Connections. 4-5
Transducer Materials 4-5
Transducer Mounting and Installation 4-5
Transducer Number, Entering 2-7
Transducer Type. 4-5
Transducer Wiring Diagram. 1-17
Transducer/Flowcell Specifications 4-5
Transducers
180° Installation D-1
Axial Dimension D-1
Bias 90° Installation D-1
Installation Angle D-1
Path Length D-1
Pin Assignments. 1-16
Type 4X Enclosure, Drawing. 1-15

W

Wiring
CE Mark Compliance. A-1
Foundation Fieldbus. 1-12
Wiring Diagram, Type 4X Housing 1-16

GE
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DECLARATION OF CONFORMITY

We,

Panametrics Limited
Shannon Industrial Estate
Shannon, County Clare
Ireland

declare under our sole responsibility that the

DF868 Liquid Ultrasonic Flowmeter
GF868 Flare Gas Ultrasonic Flowmeter
GM868 Multi-Purpose Gas Ultrasonic Flowmeter
GN868 Natural Gas Ultrasonic Flowmeter
GS868 Steam Mass Ultrasonic Flowmeter

to which this declaration relates, are in conformity with the following standards:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN 61010-1:1993 + A2:1995, Overvoltage Category II, Pollution Degree 2

following the provisions of the 89/336/EEC EMC Directive and the 73/23/EEC Low Voltage Directive.

The *units listed above and any transducers supplied with them (spoolpieces are addressed under a separate declaration of conformity)* do not bear CE marking for the Pressure Equipment Directive, as they are supplied in accordance with Article 3, Section 3 (sound engineering practices and codes of good workmanship) of the Pressure Equipment Directive 97/23/EC for DN<25.

Shannon - June 1, 2002

Mr. James Gibson
GENERAL MANAGER

CE

I.S. EN ISO 9002
Shannon

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DECLARATION DE CONFORMITE

Nous,

Panametrics Limited
Shannon Industrial Estate
Shannon, County Clare
Ireland

déclarons sous notre propre responsabilité que les

DF868 Liquid Ultrasonic Flowmeter
GF868 Flare Gas Ultrasonic Flowmeter
GM868 Multi-Purpose Gas Ultrasonic Flowmeter
GN868 Natural Gas Ultrasonic Flowmeter
GS868 Steam Mass Ultrasonic Flowmeter

rélatif á cette déclaration, sont en conformité avec les documents suivants:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN 61010-1:1993 + A2:1995, Overvoltage Category II, Pollution Degree 2

suivant les régles de la Directive de Compatibilité Electromagnétique 89/336/EEC et de la Directive Basse Tension 73/23/EEC.

Les *matériels listés ci-dessus ainsi que les transducteurs pouvant être livrés avec (les manchettes faisant l'objet d'une déclaration de conformité séparée)* ne portent pas le marquage CE de la directive des équipements sous pression, car ils sont fournis en accord avec la directive 97/23/EC des équipements sous pression pour les DN<25, Article 3, section 3 qui concerne les pratiques et les codes de bonne fabrication pour l'ingénierie du son.

Shannon - June 1, 2002

Mr. James Gibson
DIRECTEUR GÉNÉRAL

CE

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KONFORMITÄTS-ERKLÄRUNG

Wir,

Panametrics Limited
Shannon Industrial Estate
Shannon, County Clare
Ireland

erklären, in alleiniger Verantwortung, daß die Produkte

DF868 Liquid Ultrasonic Flowmeter
GF868 Flare Gas Ultrasonic Flowmeter
GM868 Multi-Purpose Gas Ultrasonic Flowmeter
GN868 Natural Gas Ultrasonic Flowmeter
GS868 Steam Mass Ultrasonic Flowmeter

folgende Normen erfüllen:

- EN 61326:1998, Class A, Annex A, Continuous Unmonitored Operation
- EN 61010-1:1993 + A2:1995, Overvoltage Category II, Pollution Degree 2

gemäß den Europäischen Richtlinien, Niederspannungsrichtlinie Nr.: 73/23/EG und EMV-Richtlinie Nr.: 89/336/EG.

Die *oben aufgeführten Geräte und zugehörige, mitgelieferte Schallwandler (Messrohre werden in einer separaten Konformitätserklärung behandelt)* tragen keine CE-Kennzeichnung gemäß der Druckgeräte-Richtlinie, da sie in Übereinstimmung mit Artikel 3, Absatz 3 (gute Ingenieurpraxis) der Druckgeräte-Richtlinie 97/23/EG für DN<25 geliefert werden.

Shannon - June 1, 2002

Mr. James Gibson
GENERALDIREKTOR

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